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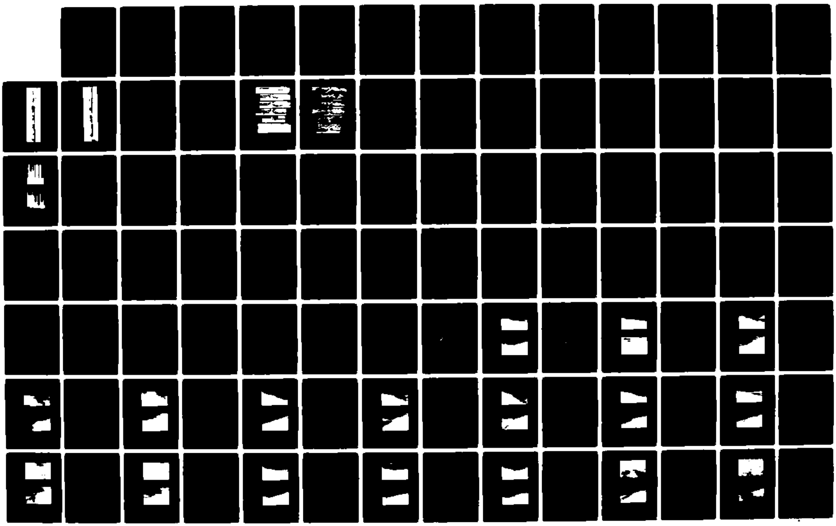

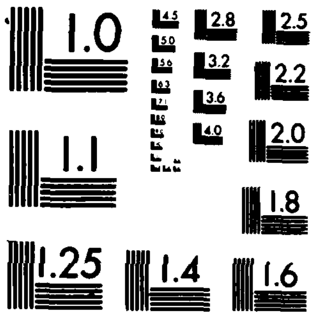

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Beach Changes at Holden Beach, North Carolina, 1970-74

by

Martin C. Miller

MISCELLANEOUS REPORT NO. 83-5

MARCH 1983

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Kingman Building

Fort Belvoir, Va. 22060

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Beach profile lines at 21 near-evenly spaced intervals along Holden Beach, North Carolina, between Lockwoods Folly and Shallotte Inlets, were measured from November 1970 to December 1974. These have been analyzed to determine the spatial and temporal variabilities on long-term, seasonal, and short-term scales. Profile lines near the inlets showed the greatest variability in mean sea level (MSL) position, above MSL volume, foreshore slope, and profile envelope. This variability near Lockwoods Folly Inlet was partly

(continued)

enhanced by artificial nourishment at profile line 2. Temporary, low-cost shore protection devices (e.g., sandbag groins) were constructed near that inlet during part of the study. No other modifications or activities that affected beach processes were known to occur during the study period.

The central part of Holden Beach was studied separately because of the high variability of the inlet sections at either end of the island. Foreshore slopes along this reach increased from an average of 1:30 at the east end to 1:17 at the west. A seasonal change in above MSL volume indicates loss of sand during autumn and winter, and a gain during spring and summer. Changes in MSL shoreline intercept and above MSL volume were highly variable during the study. Regression analysis and total annual rates of change indicate that the MSL shoreline is advancing while above MSL volume is decreasing. The net sand loss along the central reach was met or exceeded by gains along the inlet reaches. Wind data showed that strong winds occurred less frequently than normal during the study, and few major storms had an impact on the beach. Erosion events correlated with high water levels and strong onshore winds (near 10 meters per second) while accretion events correlated with gentle, onshore winds for several days before the survey. Visual wave data indicated that westward littoral transport predominated two to three times the eastward transport. The extreme variability of the inlet sections in comparison to the central section emphasizes the need for a different sampling approach to understand these disparate environments.

PREFACE

This report is one of a series describing the results of the U.S. Army Coastal Engineering Research Center's (CERC) Beach Evaluation Program. One aspect of the program, and the subject of this report, is to provide basic engineering information on changes in the volume of sand on beaches above mean sea level, and on changes in shoreline position, as obtained from long-term beach survey projects. The work was carried out under the Beach Profiles Studies work unit, Beach Protection and Restoration Program, Coastal Engineering Area of the Corps of Engineers Research and Development.

The report was prepared by Dr. Martin C. Miller, Science Applications, Inc. (SAI), Raleigh, North Carolina, under CERC contract No. DACW72-79-C-0020. Beach profile surveys were performed by the W.W. Blanchard Company, Wallace, North Carolina, under contract to the U.S. Army Engineer District, Wilmington. Visual wave data were contributed by J.M. Clarke and E.D. Gray. M.V. Fleming, T.J. Lawler, J. Buchanan, and B.R. Sims developed the CERC computer programs used for editing, analyzing, and displaying the beach profile data. J.L. Miller, J.A. Tarnowski, and K.P. Zirkle (CERC) assisted in data reduction. Eigenfunction analysis programs were written by D.G. Aubrey, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts. The author acknowledges and appreciates the helpful review comments from D.G. Aubrey, A.E. DeWall, and B.R. Hall (CERC), and J.T. Jarrett, U.S. Army Engineer District, Wilmington.

A.E. DeWall was the contract monitor, under the general supervision of R.M. Sorenson, former Chief, Coastal Processes and Structures Branch, and Mr. R.P. Savage, Chief, Research Division, CERC.

Technical Director of CERC was Dr. Robert W. Whalin, P.E.

Comments on this report are invited.

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Commander and Director

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CONVERSION FACTORS, U.S. CUSTOMARY TO METRIC (SI) UNITS OF MEASUREMENT

U.S. customary units of measurement used in this report can be converted to metric (SI) units as follows:

Multiply	by	To obtain
inches	25.4	millimeters
	2.54	centimeters
square inches	6.452	square centimeters
cubic inches	16.39	cubic centimeters
feet	30.48	centimeters
	0.3048	meters
square feet	0.0929	square meters
cubic feet	0.0283	cubic meters
yards	0.9144	meters
square yards	0.836	square meters
cubic yards	0.7646	cubic meters
miles	1.6093	kilometers
square miles	259.0	hectares
knots	1.852	kilometers per hour
acres	0.4047	hectares
foot-pounds	1.3558	newton meters
millibars	1.0197×10^{-3}	kilograms per square centimeter
ounces	28.35	grams
pounds	453.6	grams
	0.4536	kilograms
ton, long	1.0160	metric tons
ton, short	0.9072	metric tons
degrees (angle)	0.01745	radians
Fahrenheit degrees	5/9	Celsius degrees or Kelvins[1]

[1] To obtain Celsius (C) temperature readings from Fahrenheit (F) readings, use formula: C = (5/9) (F -32).

To obtain Kelvin (K) readings, use formula: K = (5/9) (F -32) + 273.15.

BEACH CHANGES AT HOLDEN BEACH, NORTH CAROLINA, 1970-74

by
Martin C. Miller

I. INTRODUCTION

1. Background.

This report is one of a series which analyzes and interprets beach profile data collected along several east coast beaches during the period 1962-75. Beach profile data from 21 profile lines on the oceanside of Holden Beach, North Carolina (Fig. 1) were collected from November 1970 to December 1974 by the U.S. Army Engineer District, Wilmington, as part of the U.S. Army Coastal Engineering Research Center's (CERC) Beach Evaluation Program (BEP) (formerly known as the Pilot Program for Improving Coastal Storm Warnings or the Storm Warning Program). The BEP was initiated after the Great East Coast Storm of March 1962 to observe variations on typical beaches in response to waves and tides of specific intensity and duration. Twelve beaches in the region hardest hit by the storm (Massachusetts to North Carolina) are under study in this program.

This report presents an analysis and interpretation of data collected at Holden Beach, documents the locations of the profile lines, and evaluates the relationship of changes in the beach elevation, sand volume, and shoreline position to changes in waves, water level, sediment size and supply, storm events, and coastal structures. The analysis includes a review of previous studies of the area to determine the relevant long-term trends in waves, winds, tides, and inlet processes.

Variability in the shape of the beach profile was analyzed using the empirical eigenfunction technique as well as by other standard methods performed by CERC. Changes were evaluated on three time scales: (a) short-term changes caused by individual storms or events occurring between surveys; (b) seasonal changes observed over the typical 3-month season; and (c) long-term changes that occur on time scales of 1-year or more.

2. Previous Work.

There have been few detailed studies which provide insight into processes along the barrier islands of southern North Carolina; none has concentrated on Holden Beach. The most comprehensive study was developed for Yaupon and Long Beaches to the immediate east of Holden Beach by the U.S. Army Engineer District, Wilmington (1973). The study also provides information on processes active at Lockwoods Folly Inlet, as well as along the eastern end of Holden Beach, and summarizes wave, wind, and other general climate data. Langfelder, Stafford, and Amein (1968) and Wahls (1973) used aerial photography to determine the erosion rates of North Carolina's barrier islands. The results of the former study were reviewed in U.S. Army Engineer District, Wilmington (1973) and will be referred to later in this report. Langfelder, et al. (1974) and Baker (1977) used successive aerial photos to compare changes occurring in the coastal inlets at either end of Holden Beach from 1938 to 1976. Machemehl, Chambers, and Bird (1977) combined aerial photo analysis and information from coastal survey maps to

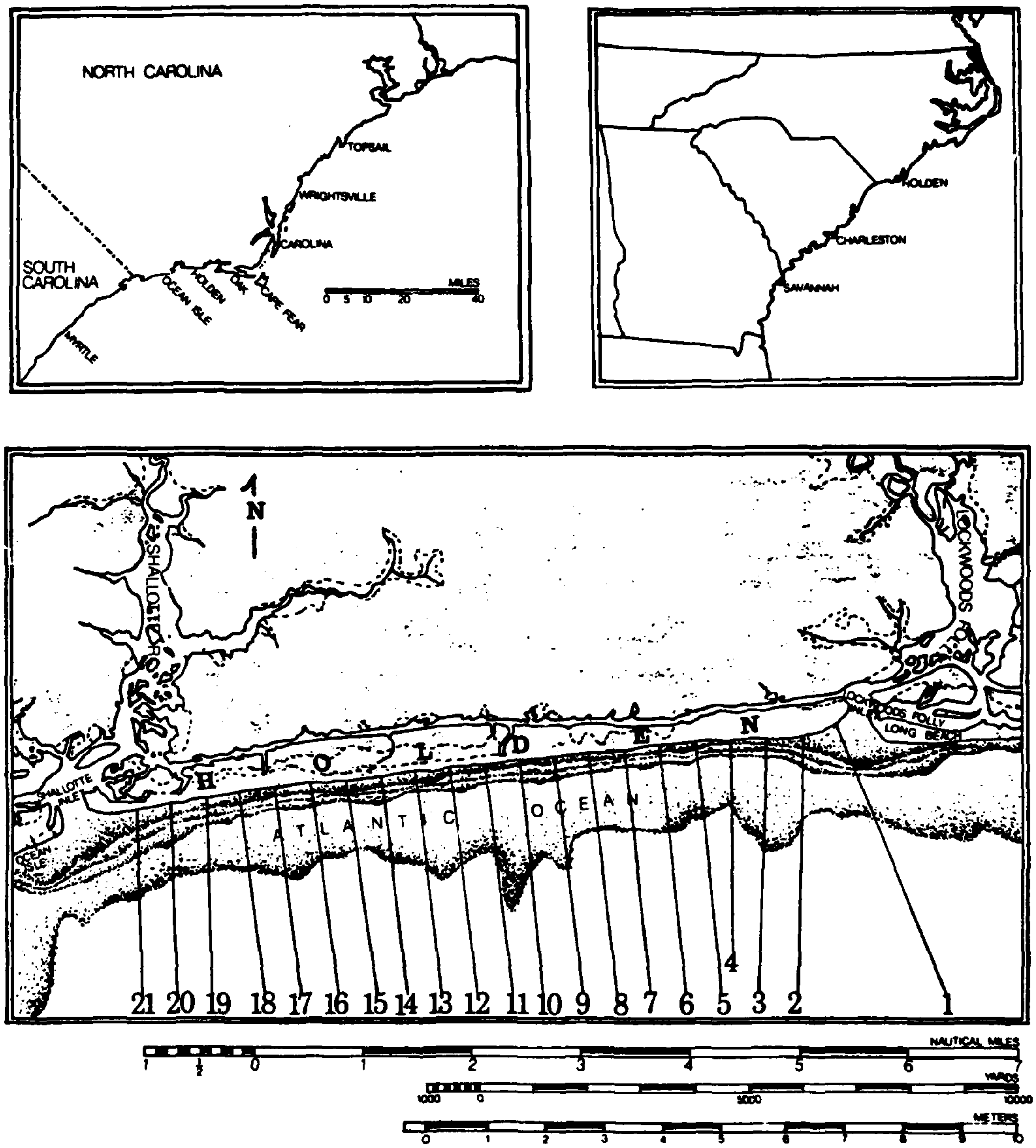


Figure 1. Profile line locations along Holden Beach, Brunswick County, North Carolina.

extend the history of inlet change to 1859. They also developed a model of tidal flow and water level change for Lockwoods Folly Inlet.

This report concentrates on the analysis and interpretation of the Holden Beach data collected during the BEP study and relates the beach changes to the environmental factors of waves, winds, and water levels that occurred during that period. Aspects of these previous studies which relate to beach processes during the period are used to provide additional insights.

II. THE STUDY AREA

1. Geography and Geomorphology.

a. Geomorphic Setting. The shoreline of Holden Beach, a barrier island located on the Atlantic Ocean along the southern coast of North Carolina about 30 kilometers west of Cape Fear (Fig. 1), is oriented almost exactly east-west. Separated from the mainland by salt marsh and the Atlantic Intracoastal Waterway (AIWW), the island is terminated at the east and west ends by Lockwoods Folly and Shallotte Inlets, respectively, each associated with a river of the same name. Sediment contribution from these slowly flowing coastal streams is negligible. Both are unstructured, active tidal inlets with migrating channels. The main, natural tidal channel for each inlet curves east and flows in a southeasterly direction adjacent to the shoreline east of each inlet. Lockwoods Folly Inlet and the AIWW in its general vicinity are dredged by the Corps of Engineers, and an artificially developed entrance channel has been cut in a north-south direction through the Lockwoods Folly sandbar. Sand from the maintenance dredging operations is beach sand, transported into the inlet by littoral currents and tides and is disposed of on the east end of Holden Beach, near profile lines 1 and 2, to supplement the existing beach.

Holden Beach is one of a chain of 17 barrier islands along the 237-kilometer coastline of the Atlantic Ocean between Cape Lookout and the southern North Carolina border. The island, characterized as having a low mesotidal shoreline (Hayes, 1979), has a mean tidal range of 1.35 meters. There is only one shore protection structure on the 13.2-kilometer-long beach--a short (about 24 meters) wooden bulkhead near profile line 4. Comparison of profile line measurements taken nearest the fishing pier east of profile line 10 with others along the beach indicates that the pilings and open truss works of the pier do not restrict littoral transport.

A massive dune ridge at the eastern end of the island is heavily vegetated and extends west about one-fourth of the island's length (Cleary and Hosier, 1979) (Fig. 2); the central reach is narrower and backed by a single, low dune ridge. Finger canals have been dredged on the north side of the central reach to extend waterfront property, with access to the AIWW, for housing construction. The dredged material was used as fill before this construction. The eastern end of the island has experienced washovers and changes in inlet formation during severe storms. West of the finger canals, the final length of the island broadens and is composed of massive vegetated dunes and single or multiple dune ridges. Those adjacent to the inlets are probably associated with inlet migration, while those more inland are shaped

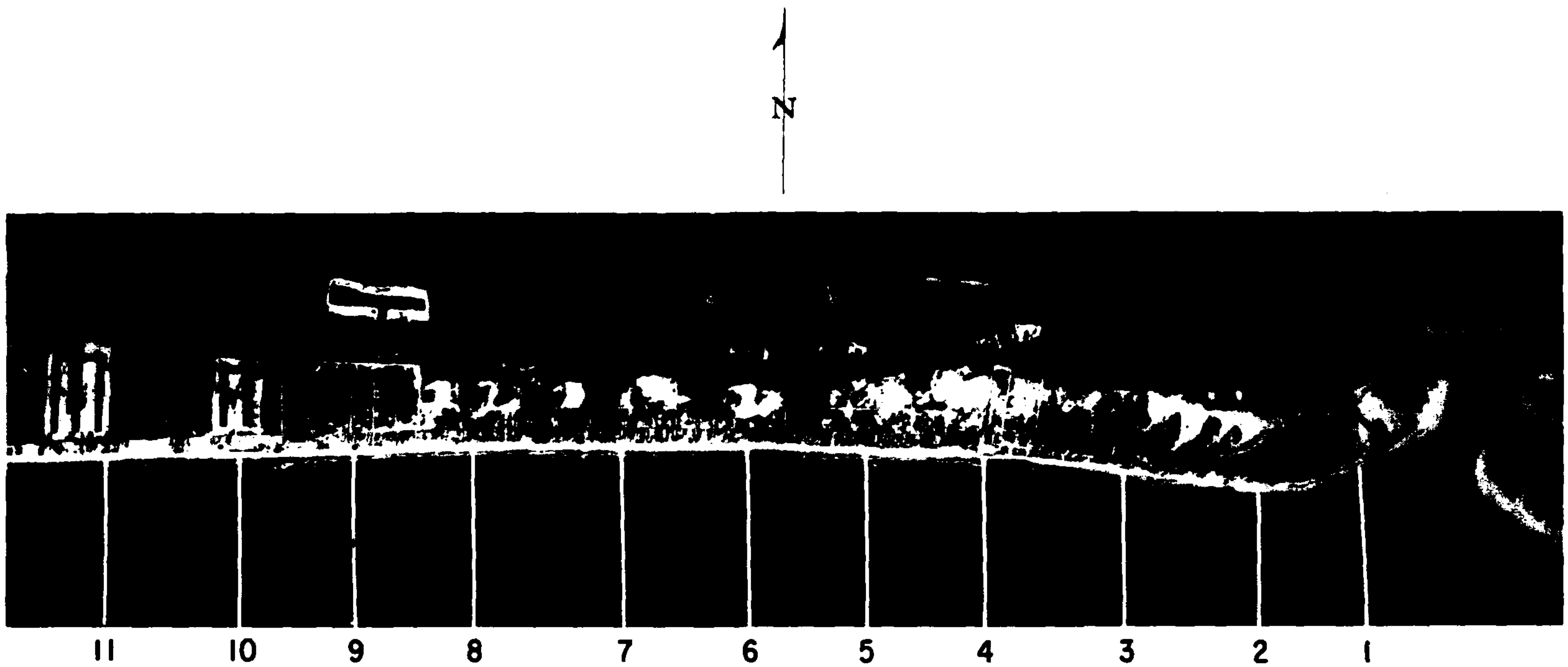


Figure 2. Aerial photo mosaic of Holden Beach (eastern half), August 1971.

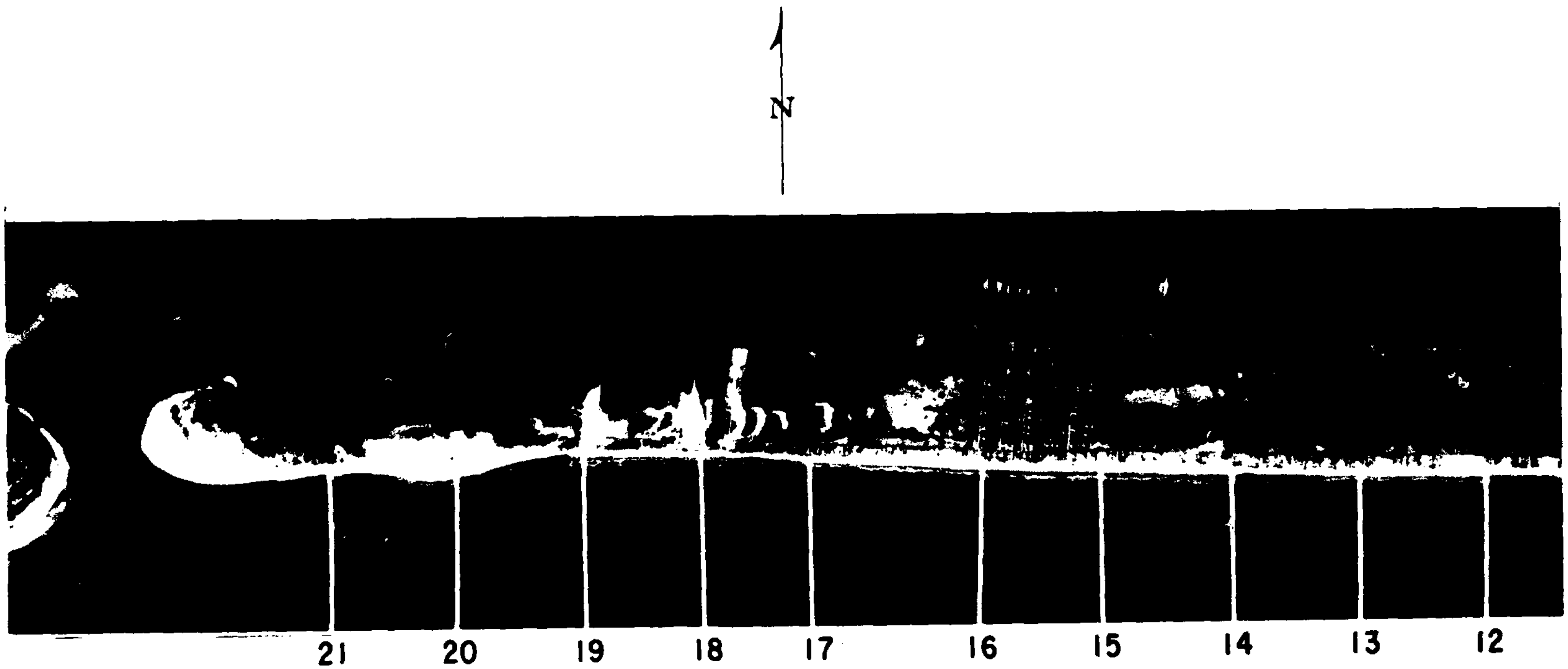


Figure 2. Aerial photo mosaic of Holden Beach (western half), August 1971.--Continued

and migrate under the influence of wind action (Dr. W. Cleary, University of North Carolina at Wilmington, personal communication, 1981). The width of the dunes varies, averaging 250 meters from the ocean to the AIWW with heights from 2.5 to 5 meters (Boc and Langfelder, 1977). Beach material is composed of clean, medium sand, moderately to moderately well sorted (U.S. Army Engineer District, Wilmington, 1973).

b. Inlet History. Early maps and historical records dating to the 1850's of the Holden Beach area show at least two other inlets between Lockwoods Folly and Shallotte Inlets. Mary's Inlet, which cuts northeast through the island, was located about 5.8 kilometers west of Lockwoods Folly near profile line 9 (Fig. 2). Bacon's Inlet was located between profile lines 15 and 16 (Fig. 2). U.S. Coast and Geodetic Survey coastal charts prepared in 1923 show both inlets open. Bacon's Inlet was closed by 1933, and some time between then and 1938, aerial photos indicated Mary's Inlet was closed. Neither has reopened (U.S. Army Engineer District, Wilmington, 1973).

Hurricane Hazel in November 1954 was particularly devastating for the North Carolina coast. This storm caused two breakthroughs on Holden Beach—one near the site of the old Mary's Inlet, the other near the west end of the island. Both had filled by natural means by 1959. Some washovers occurred during intense storms in the late 1950's and early 1960's; however, 1974 aerial photos indicate Holden Beach was relatively stable during several preceding years. The central part of the island, which is lowest and narrowest, is highly susceptible to washover or breakthrough, while the risk is considered moderate to none along the massive dunes at the eastern and western ends (Pilkey, Neal, and Pilkey, 1978; Cleary and Hosier, 1979). The Great East Coast Storm of March 1962 had no particular effect on Holden Beach. The center of that storm was located considerably north of Holden Beach, off the coast of New Jersey, and the orientation of the island protected it from the large storm-generated waves arriving from the north and northeast.

Shallotte and Lockwoods Folly Inlets have remained open but have shown considerable variability through the years. In 1859, Lockwoods Folly was located about 600 meters east of its present location (Fig. 3). Though the shorelines of the ends of Holden Beach and Long Beach on the other side of Lockwoods Folly Inlet have varied, as shown in Figure 3, the inlet position has remained fairly constant since 1923. Aerial photos from 1938 to 1972 show the inlet gorge extending southward from the AIWW and curving sharply eastward along the shore of Long Beach (Fig. 4) (Langfelder, et al., 1974; Baker, 1977; Machemehl, Chambers, and Bird, 1977). The exit channel, presently maintained by the Corps of Engineers, is a southern extension of the natural channel through the existing bar. The shape of the bar indicates predominantly eastward littoral transport (Langfelder, et al., 1974; Machemehl, Chambers, and Bird, 1977).

The shape of Shallotte Inlet, as seen in successive aerial photos (Fig. 5), has varied more than Lockwoods Folly. The 1938 photo shows the inlet gorge oriented southwest; however, over the years a reorientation of the inlet discharge is shown toward the southeast along the western tip of Holden Beach. With the exception of dredging for the AIWW, which began before 1938, there has been no maintenance dredging in the inlet. This reorientation is probably associated with the AIWW and the increase in tidal flushing caused by the dredging of the channel behind the adjacent islands.

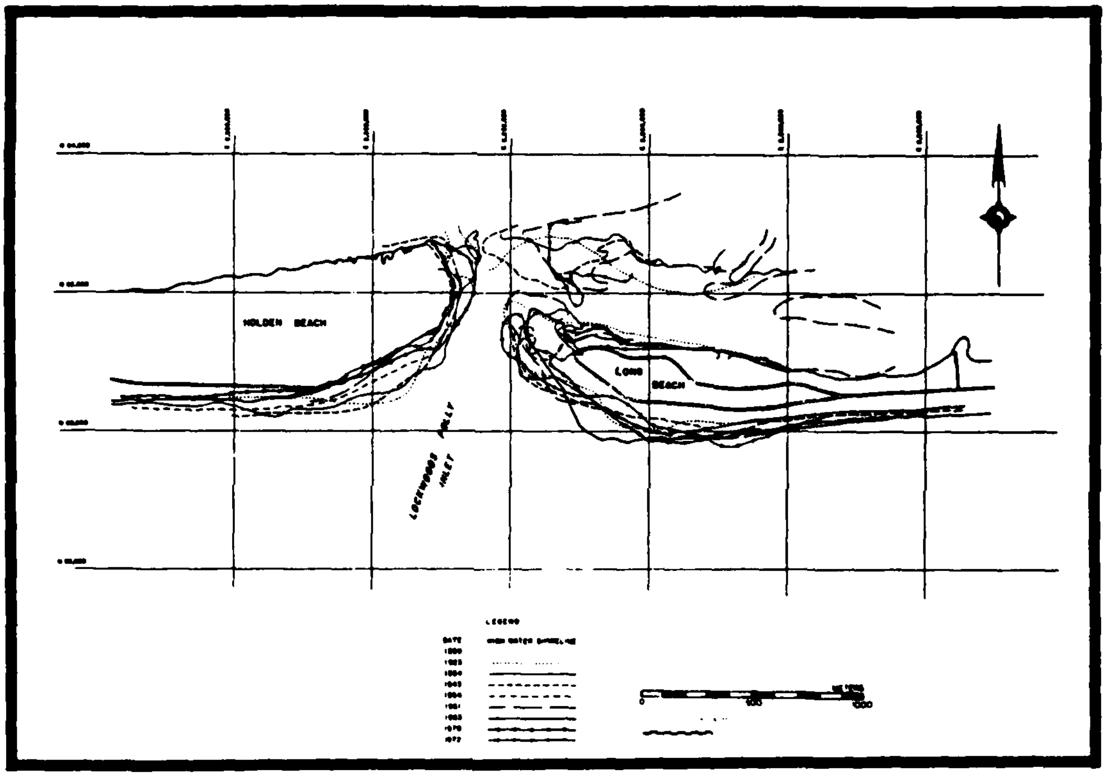


Figure 3. Changes in Lockwoods Folly Inlet, 1859-1972. Grid lines are the North Carolina coordinate system in feet (U.S. Army Engineer District, Wilmington, 1973).

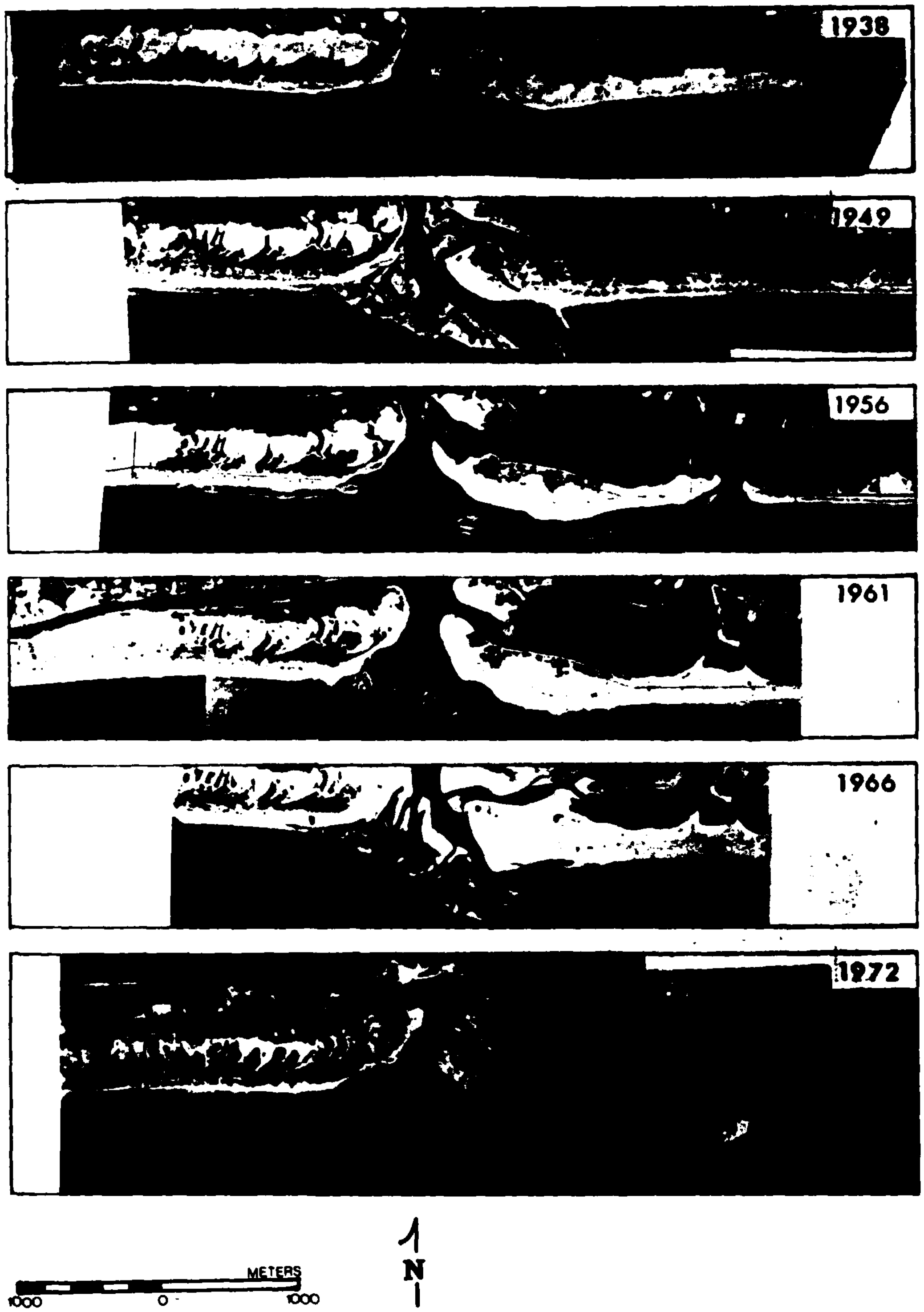


Figure 4. Aerial photos of Lockwoods Folly Inlet, 1938-72 (Langfelder, et al., 1974).

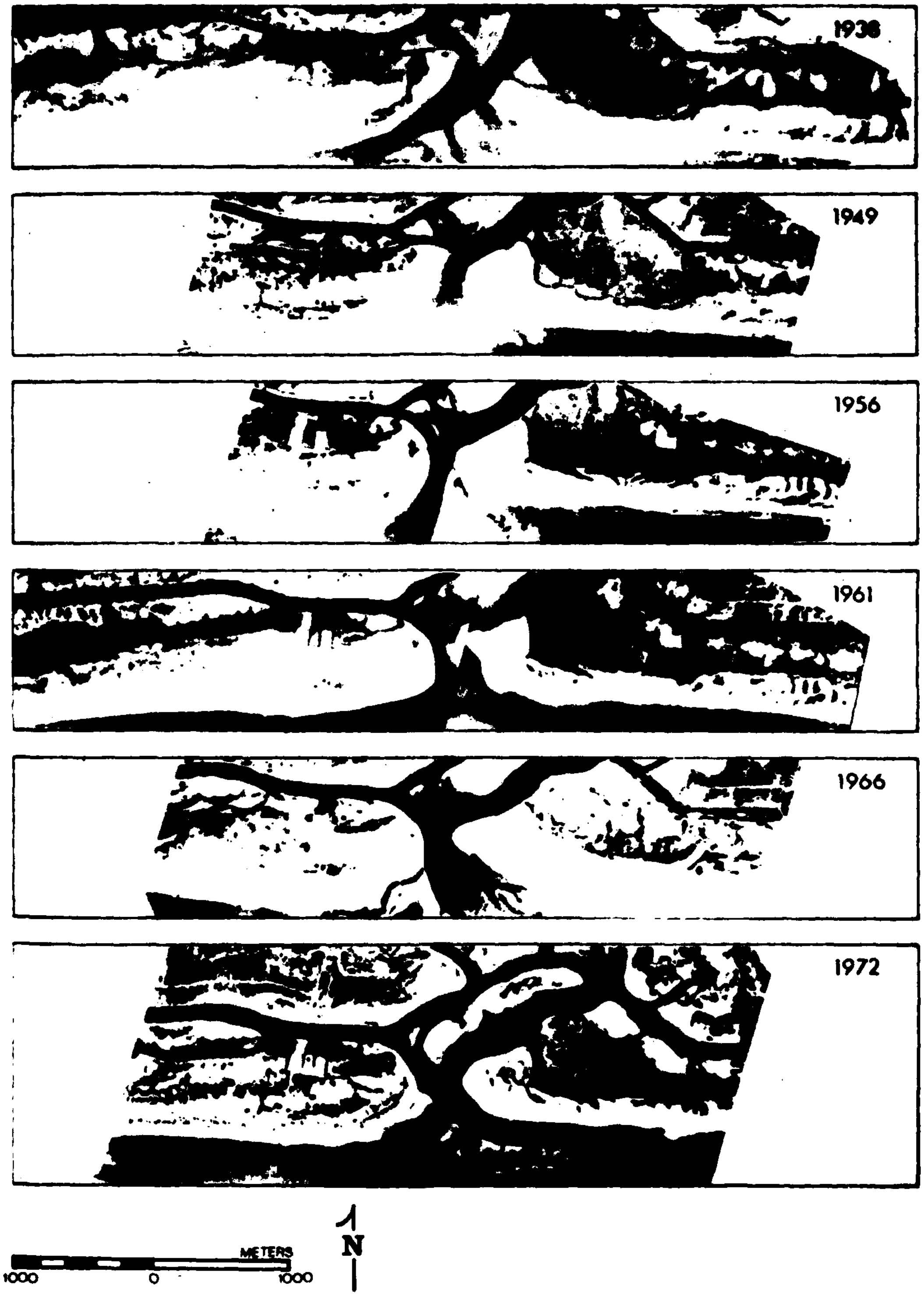


Figure 5. Aerial photos of Shallotte Inlet, 1938-72 (Langfelder, et al., 1974).

2. Littoral Processes.

a. Wind Speed and Direction. Figure 6 compares the long-term average wind speed and direction at Wilmington, North Carolina, 56 kilometers northeast of Holden Beach, from 1948 to 1960 (U.S. Army Engineer District, Wilmington, 1973), with the wind speed and direction during the study period (1970-74). The predominant winds, both in terms of duration and speed, occur from the southwest direction. Winds from the southwest were more persistent than normal and, in all cases, were more moderate than normal. There were no significant storms during the study period. Winds from the south and southwest predominate during the spring and summer months; north and northeast winds occur during the winter. All sections of Holden Beach are vulnerable to hurricane winds from the south and east (Carney and Hardy, 1967).

b. Wave Climate. A continuous-wire staff wave gage, installed on the fishing pier at Holden Beach in February 1971, recorded wave height and period for 1,024-second intervals every 4 hours through February 1975, as shown in Figure 7 (Thompson, 1977). Figure 8 shows monthly averages of significant wave heights and periods from April 1971 to December 1974 and the composite mean for the entire period; the vertical lines represent the standard deviation. Periods of calm, according to visual observations over the same period, comprised fewer than 1 percent of the readings. The highest average waves were observed in June, though this may be an anomalous month since only 1972 was recorded. Mean wave heights were greater than 60 centimeters from February through August with the least mean height recorded in October. Mean wave periods for the interval were 7.38 seconds with longest periods in September and November and shortest during April, June, and July. The general wave height at Holden Beach is less severe than recorded by CERC wave gages to the north at Wrightsville Beach and south at Savannah, Georgia (Fig. 9). Holden Beach, exposed to the south, is protected from severe northeast storms and large, long-period ocean waves approaching from the east. Wrightsville Beach and Savannah are fully exposed to these waves (Fig. 1).

U.S. Army Engineer District, Wilmington (1973) considered the direction and rate of littoral transport along the east end of Holden Beach and other beaches (Long Beach and Yaupon Beach) immediately to the east. Although several sources of wave data were evaluated, transport rates and directions were determined using computer-generated wave refraction data for selected combinations of wave heights, periods, and angles of approach. The Wilmington District concluded that the dominant direction of transport is west to east, and that the magnitude of the easterly component ranges is 2.5 to 3.5 times the westerly component.

Littoral Environment Observations (LEO) of breaker height, period, and angle to the shoreline at Holden Beach were recorded by a trained observer. These observations were made by the same person at the same general location along the beach (i.e., near profile line 16) throughout most of the study period. Before 1974, breaker angle was recorded as approaching from a sector rather than from a discrete direction (Everts, DeWall, and Czerniak, 1980). These data, which were later converted to the LEO format, assigned sectors 2, 3, and 4 corresponding to 72°, 90°, and 108° clockwise from the

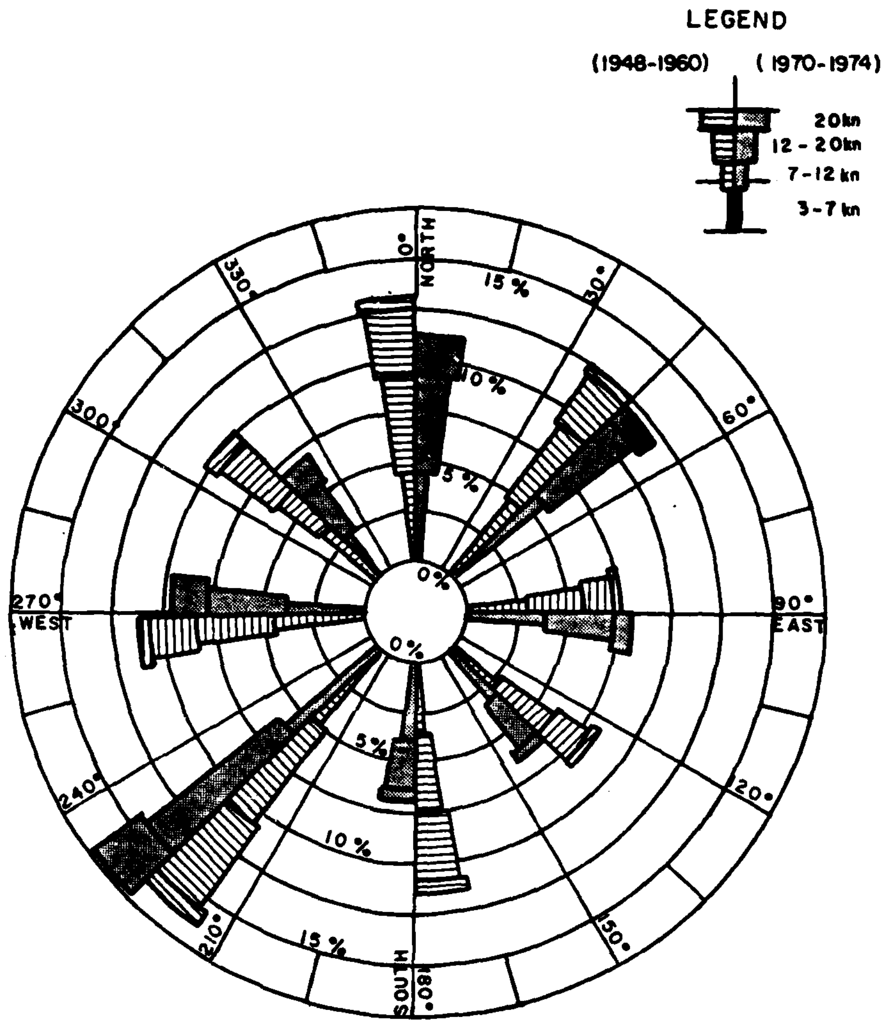


Figure 6. Comparison of wind speed and direction observed during BEP study (1970-74 inclusive) with the long-term average (1948-60) at Wilmington, North Carolina (U.S. Army Engineer District, Wilmington, 1973).

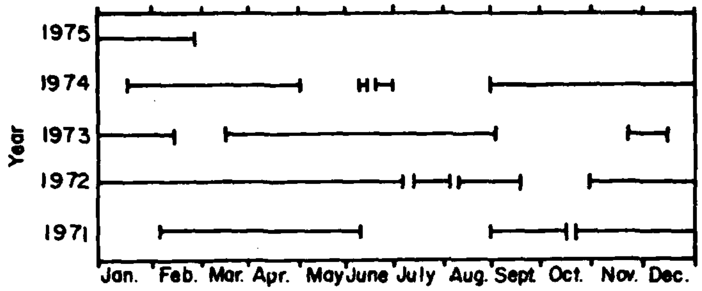


Figure 7. Recording periods of CERC wave gage on Holden Beach fishing pier near profile line 10.

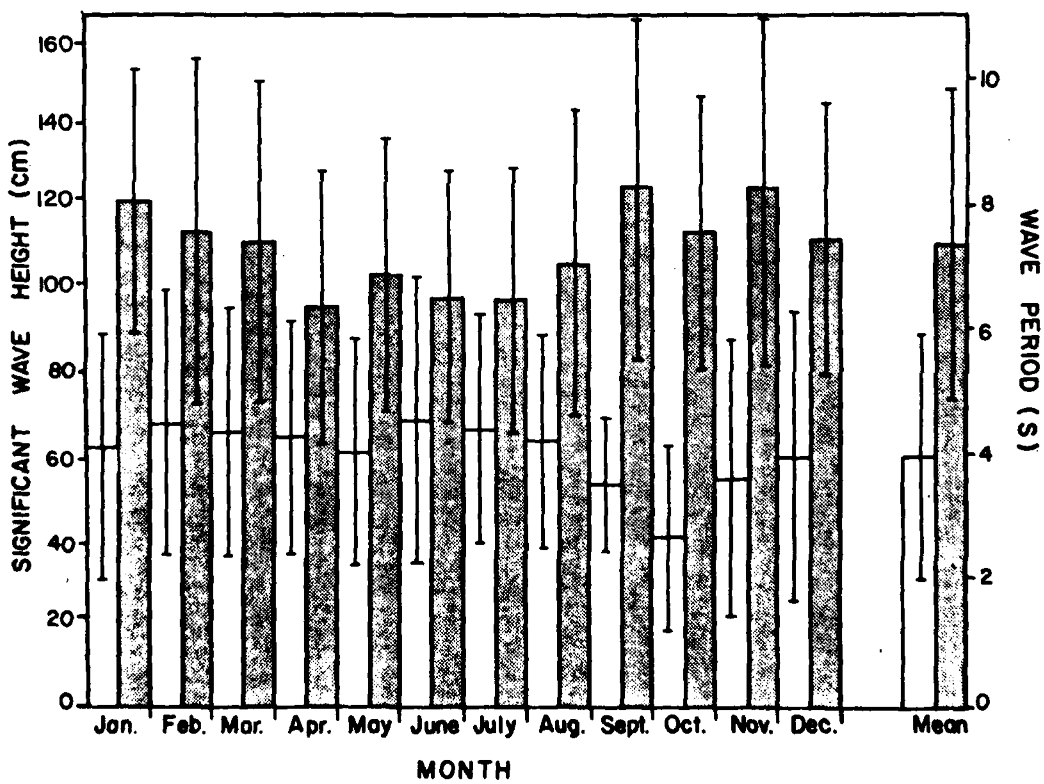


Figure 8. Monthly average significant wave height (left) and period (right, shaded). Vertical lines are one standard deviation above and below mean.

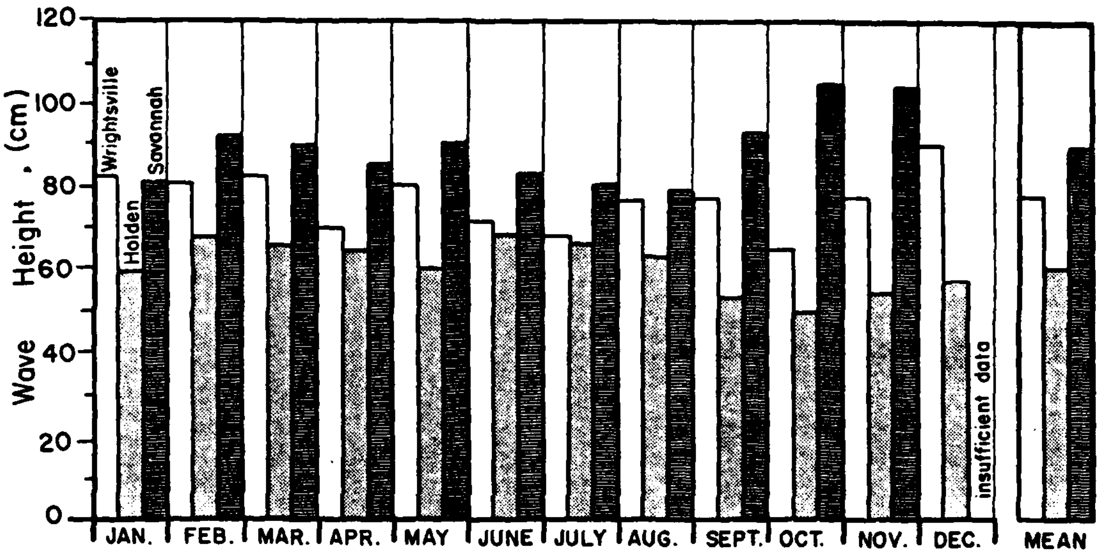


Figure 9. Monthly average significant wave heights measured at Wrightsville Beach and Holden Beach, North Carolina, and off Savannah, Georgia (Thompson, 1977).

shoreline with 0° to the left. Observations taken after 1974 corresponded to the LEO methodology (Szuwalski, 1970; Bruno and Hiipakka, 1974; Balsillie, 1975). At 90° waves approaching from directly offshore would result in no net longshore sand transport. Along Holden Beach, angles less than 90° are from the east and greater than 90° from the west, producing transport westward and eastward, respectively.

The frequency of breaker approach indicates that net transport westward predominates. Table 1 provides the relative magnitude of littoral transport calculated for each month from 1971 to 1973. These values were determined from the longshore energy flux relationship (U.S. Army, Corps of Engineers, Coastal Engineering Research Center, 1977) and can be shown to be proportional to wave height to the 5/2 power ($H^{5/2}$). The breaker angle was included only in the 1974 calculations, so the 1971-73 values and 1974 values should not be compared. The computed parameters do not represent actual transport rates, but provide relative rates and directions for each month. The estimates show that net longshore sand transport is actually westward. The table also shows that wave approach is predominantly from the east. There were several cases, however, where waves from one direction were completely overpowered by large breakers from the opposite direction. These are footnoted in Table 1.

III. METHODS

Profile Lines and Monumentation.

Twenty-one profile lines extending from Lockwoods Folly Inlet to Shallotte Inlet were surveyed along Holden Beach. The location and spacing of the profile lines are shown in Figure 2. Except for a series of sandbag groins installed near the east end of the island between profile lines 1 and 3 during 1973-74, there were no erosion control structures placed along the beach during the study period. Bulkheads in varying states of repair were present along the beach at profile lines 2, 3, and 4. Their effectiveness was not specifically monitored during the study. The survey periods and number of surveys per profile line are given in Table 2.

a. Survey Procedures. The profile lines were relatively evenly spaced along Holden Beach with distances varying from a minimum of 565.1 to 638.1 meters. The horizontal and vertical datums for each profile line were established by the firm of Moorman and Little, Inc., Fayetteville, North Carolina, for the Wilmington District. Actual profile line measurements were taken by the firm of W. W. Blanchard, Inc., Wallace, North Carolina. Monuments consisted of capped, galvanized pipes embedded in the dune or backshore area with reference ties measured to local cultural features where possible with third-order survey control providing the geodetic and state-plane coordinates of the monument. Vertical control at each profile line consisted of a third-order elevation of the top of the monument with respect to the National Geodetic Vertical Datum of 1929. Documentation of each profile line monument, as well as ground photos of each site, is provided in Appendix A.

Surveying crews measured each profile line, using a level and tape technique, and established a reference elevation at a fixed object such as the top of a log barricade, the foot spike on a telephone pole, or nail markers driven into the roadway. The survey proceeded seaward, approximately perpendicular to the shoreline, from the reference along the preselected azimuth,

Table 1. Relative longshore energy flux (proportional to $H^{5/2}$) by month from visual wave observations.

Year	Month	No. of observations: Onshore	Calm	Approach from 72° (left)	Approach from 108° (right)	Flux toward West (right)	Flux toward East (left)	Net	Pct of month observed
1971	Jan.	6	0	0	6	0	-12.50	-12.50	38.7
	Feb.	1	0	3	2	4.76	- 2.0	2.76	21.4
	Mar.	21	0	3	7	.53	-10.88	-10.35	100.
	Apr.	15	0	4	4	7.83	-16.39	- 8.56	76.7
	May[1]	9	0	4	3	10.41	-18.52	- 8.11	51.6
	June[1]	17	1	6	3	17.83	-21.13	-13.30	90.0
	July[1]	16	0	4	3	8.44	-18.30	- 9.85	74.3
	Aug.	10	0	14	1	37.68	- 5.66	32.02	80.6
	Sept.	11	0	15	1	25.86	- 1.00	24.86	90.0
	Oct.	17	0	10	1	64.77	-22.92	41.86	90.3
	Nov.	12	0	7	0	11.77	0	11.77	63.3
	Dec.	22	0	7	0	33.91	0	33.91	93.5
1972	Jan.	21	0	7	1	12.59	- 5.66	6.93	93.5
	Feb.	13	0	10	4	40.59	-26.90	13.69	93.1
	Mar.	19	0	10	2	42.45	- 8.41	34.04	100.
	Apr.	14	0	12	4	42.20	-31.08	11.12	100.
	May	13	0	8	2	44.20	- 3.76	40.44	74.2
	June	18	0	5	4	37.76	-25.00	12.75	90.0
	July	19	1	6	0	19.54	0	19.54	83.9
	Aug.	14	0	13	0	36.96	0	36.96	87.1
	Sept.	8	0	5	0	39.54	0	39.54	43.3
	Oct.	6	0	13	1	37.50	- 1.00	36.50	64.5
	Nov.[1]	13	2	6	1	14.17	-15.59	- 1.42	73.3
	Dec.	12	0	5	2	27.76	- 2.00	25.76	61.3
1973	Jan.	16	0	8	1	33.43	- 9.88	23.55	80.6
	Feb.	11	0	5	0	42.03	0	42.03	57.1
	Mar.[1]	16	0	5	2	11.41	-47.59	-36.18	74.2
	Apr.[1]	21	0	5	2	5.93	-15.54	- 9.61	93.3
	May	25	0	1	2	5.66	-34.76	-29.10	90.3
	June	20	1	9	0	50.45	0	50.45	100.
	July[1]	13	2	11	3	32.71	-35.56	- 2.85	93.5
	Aug.	6	0	4	0	16.83	0	16.83	33.3
	Sept.[2]								
	Oct.	11	1	12	1	138.77	- 5.66	133.11	80.6
	Nov.	19	0	1	1	5.66	-32.00	-26.34	70.0
	Dec.	9	0	5	1	102.00	- 9.80	92.11	48.4
1974	July	7	0	11	6	40.47	-30.34	10.13	77.4
	Aug.	7	0	13	5	32.49	-16.03	16.47	80.6
	Sept.	5	0	6	0	29.41	0	29.41	36.7

[1] Case where waves from one direction were completely overpowered by large breakers from the opposite direction.

[2] No observations.

Table 2. Summary of profile lines and surveys.

Profile line	Distance to next monument (m)	Azimuth of profile line (^{o}T)	Elevation of monument 1929 MSL datum (m)	Survey period First reading	Survey period Last reading	Total surveys
1	602.3	157°34'N	3.54	12 Nov. 70	3 Dec. 74	39
2	609.6	181°24'N	2.86	12 Nov. 70	3 Dec. 74	39
3	631.1	181°24'N	2.65	12 Nov. 70	3 Dec. 74	39
4	590.2	179°40'N	3.12	13 Nov. 70	3 Dec. 74	39
5	610.1	174°16'N	2.89	13 Nov. 70	3 Dec. 74	39
6	605.0	174°16'N	2.54	13 Nov. 70	3 Dec. 74	39
7	628.4	174°16'N	2.38	13 Nov. 70	3 Dec. 74	39
8	595.6	173°33'N	2.04	13 Nov. 70	4 Dec. 74	39
9	604.9	173°33'N	2.12	13 Nov. 70	4 Dec. 74	39
10	623.9	174°03'N	2.18	13 Nov. 70	4 Dec. 74	39
11	594.1	173°06'N	2.24	13 Nov. 70	4 Dec. 74	39
12	612.0	173°06'N	2.73	16 Nov. 70	4 Dec. 74	39
13	608.4	173°06'N	2.17	16 Nov. 70	4 Dec. 74	39
14	605.1	173°06'N	2.04	16 Nov. 70	4 Dec. 74	39
15	613.0	171°32'N	2.15	16 Nov. 70	4 Dec. 74	39
16	638.1	172°23'N	2.33	16 Nov. 70	4 Dec. 74	39
17	625.4	172°23'N	2.57	16 Nov. 70	5 Dec. 74	39
18	565.1	172°42'N	2.68	16 Nov. 70	5 Dec. 74	39
19	609.6	178°22'N	3.12	18 Nov. 70	5 Dec. 74	39
20	624.4	178°22'N	1.76	18 Nov. 70	5 Dec. 74	39
21		178°22'N	3.16	18 Nov. 70	5 Dec. 74	39

maintained by alinement of two separated, fixed objects. Readings were taken every 15 meters or at each break in the beach slope, then continued to -0.6 meter MSL by a rodman. Surveys were timed to coincide with low tide to extend to that depth. Occasionally, however, extreme water levels or surf conditions prohibited seaward extension of the profiles. Readings were taken to the nearest 1.0 foot (0.3 meter) horizontally and 0.1 foot (0.03 meter) vertically. Occasionally it was necessary to move the level, so care was taken to document the elevation and new location.

b. Survey Frequency. The distributions of the profile line measurements by year and season and by month and season are shown in Figures 10 and 11, respectively. Each season is represented by at least one survey with autumn and winter being the seasons of the least and most surveys, respectively.

Survey data were recorded in field notebooks. Range and elevation were computed by the note man in the field and then doublechecked by another member of the survey team. The detailed procedures for transcribing coding forms for computer processing are given in DeWall (1979, p. 15). All data were meticulously hand checked, and spurious points were either corrected or discarded. Profile data are shown in tabulated form in Appendix B.

c. Profile Analysis. Surveys of profile lines were analyzed by CERC and computer plots were generated for (1) change in MSL shoreline intercept (App. C), (2) above MSL change in unit volume between surveys (App. D), and (3) profile envelopes (App. E). Changes in the MSL intercept position were referred to the MSL position on the first survey of the study. Volume changes were referred to the mean above MSL volume over the study period. The distance-elevation coordinates of the MSL contour intercept with the initial survey on each profile line are defined as the origin of a coordinate system to which all subsequent surveys are referred. Negative distances indicate stations landward of the MSL intercept with the initial profile; positive distances indicate seaward stations.

The cross-sectional area of each profile was computed and bounded by three coordinate lines: (1) a vertical line projected from the landwardmost distance common to all surveys on a given profile line, (2) a horizontal line at the MSL elevation, and (3) the surveyed profile. The calculation was accomplished by summing 30.0-centimeter horizontal slices through the area from the highest elevation to MSL. The area change was then computed by subtracting the previous profile area from the measured profile area (Fig. 12). Note that the change in area (and volume) is referred to the previous survey and not the original survey. Cross-sectional areas were computed in square feet and then converted to unit volume in cubic meters per meter of shoreline.

Appendix E provides a profile envelope for each profile line. Each plot shows two lines drawn through the upper and lower extremes of the surveyed sand elevations on each profile line. The envelope of extremes contains points from different surveys, rather than trace a particular eroded or accreted profile found during one survey. This profile "sweep zone" is useful for designing the required depth of footings for coastal structures, burial depth for pipelines, and for other beach protection or improvement considerations.

The temporal and spatial variability of each profile was also evaluated using empirical eigenfunction analysis. This technique has been used in a

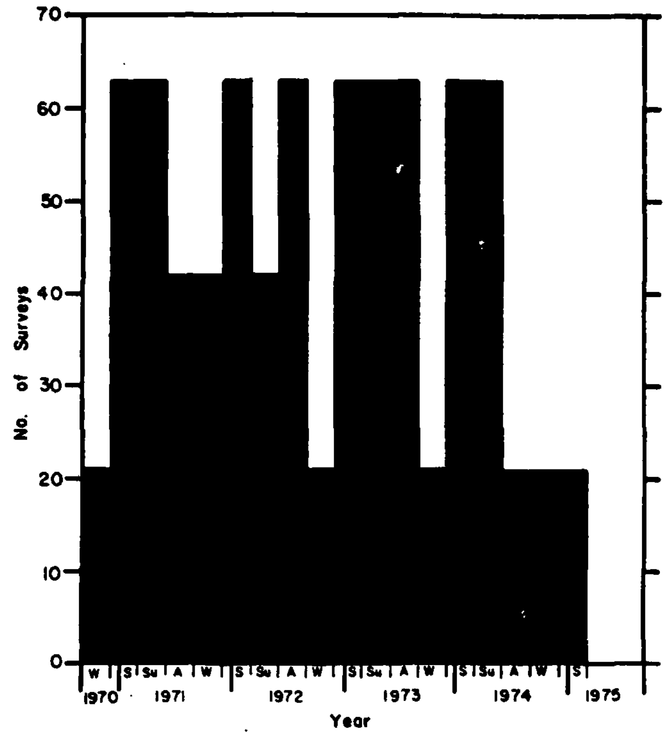


Figure 10. Frequency distribution of profile line surveys by year and season.

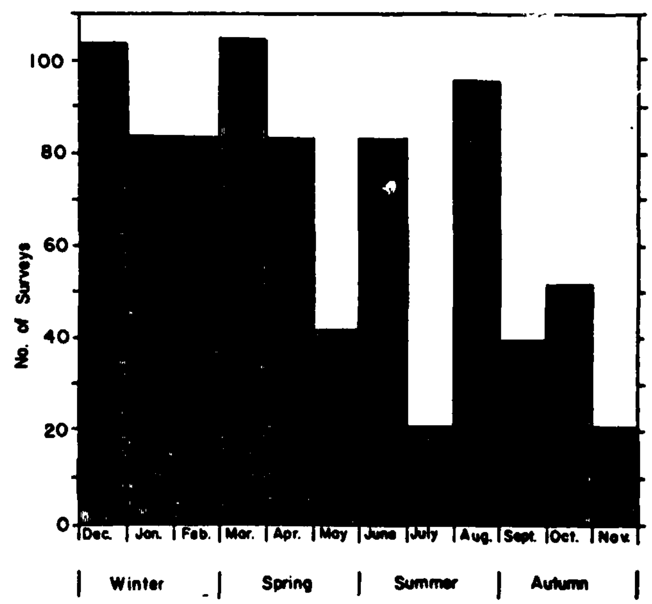


Figure 11. Frequency distribution of profile line surveys by month and season.

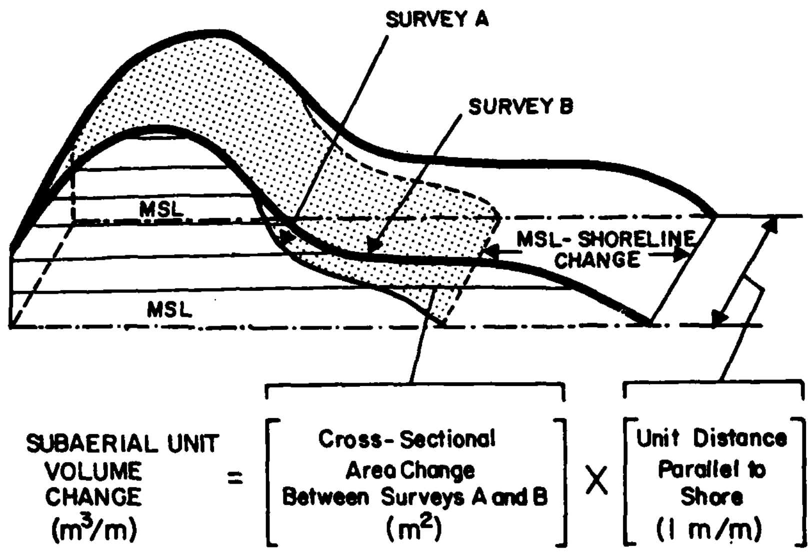


Figure 12. Definition of MSL shoreline change and above MSL unit volume change (from DeWall, 1979).

variety of scientific disciplines for many years (Lorenz, 1959), but it has only recently been applied to examining variability within the coastal zone. When applied to analysis of a profile line resurveyed over a period of time, the method is useful in determining the topographic variability in the onshore-offshore direction and in time. A comparison of the eigenfunctions of a series of profiles is useful in determining the longshore variability. The technique has been applied to studies on beaches, islands, and other coastal and bathymetric features on both the Atlantic and Pacific coasts (Winant, Inman, and Nordstrom, 1975; Vincent, et al., 1976; Resio, et al., 1977; Aubrey, 1979).

The objective of eigenfunction analysis is to separate the temporal and spatial dependence of the data set so that it can be represented as a linear combination of corresponding functions of time and space (Winant, Inman, and Nordstrom, 1975). This helps identify processes responsible for profile line changes, assists in evaluation of their relative importance, and aids the identification of specific events.

The shape of a single profile line changes between measurements in response to the many processes (e.g., waves, wind, water level, etc.) active on the beach. A careful evaluation of the profile line measured frequently over time may reveal systematic changes in its shape. Regular seasonal changes in profile area, for instance, were obvious on west coast beaches before being quantitatively confirmed by empirical eigenfunction analysis (Shepard, 1963; Aubrey, 1979). Along a single profile line, zones of maximum variation are to be expected in the region of maximum wave energy dissipation. This has also been confirmed by empirical eigenfunctions on west coast beaches (Aubrey, 1979). However, the technique does not explain the physical reason for the variability. In the case of beach profiles, the sand is moved in response to wave forcing in a manner which is assumed to be deterministic, or at least statistically predictable. It is hoped that since the wave forcing provides most of the variability, the eigenfunctions will reflect this mechanism. By examining the temporal structure of the beach eigenfunctions along with spatial structure, the decision can be made as to whether, in fact, the eigenfunctions represent some physically meaningful process. This has been shown to be the case in nearshore profile studies (Aubrey, 1979).

Profiles obtained during the BEP do not extend beyond about the -0.61-meter MSL shoreline. For that reason, beach variability associated with sediment motion and seasonal sand storage in the offshore zone, below MSL, are not included in the study and impose a limitation in the method of analysis. It is known that the breaker zone and nearshore are regions of active transport both onshore-offshore and alongshore. Offshore bars act as periodic storage areas for sand that is later supplied to the beach under favorable wave conditions. The time periods and detailed response of these regions cannot be determined from the available data.

IV. RESULTS

1. Temporal Variability.

a. Long-Term Changes. The long-term erosion rates along Holden Beach have been studied by several investigators who compared the shoreline positions on historical maps and sequences of aerial photos. The net erosion along the east end of the island (beginning between profile lines 3 and 4)

from 1932 to 1970 is shown in Figure 13. This is the highest rate of erosion in Brunswick County, averaging about 4.5 meters per year from 1943 to 1970. Erosion rates over the rest of the island have been quite variable in time (Fig. 14). The shoreline of the eastern reach exhibited a recession rate of about 0.71 meter per year from 1942 to 1970. Langfelder, Stafford, and Amein (1968) and Langfelder, et al. (1974) used aerial photos to determine the recession of the high water line as well as the dune line. The erosion rate of both lines has been nearly the same since 1957 and approximately parallels the slope of the recession determined by U.S. Army Engineer District, Wilmington (1973). All three studies indicate a marked change in the rate of erosion after the early 1960's. The positive slope of the high water line during the latter years of the study indicate a seaward growth of 0.66 meter per year (broken line, Langfelder, et al., 1974) and 0.30 meter per year (solid line). A more recent study (Wahls, 1973) estimated the composite erosion rate (from Shallotte Inlet to Lockwoods Folly Inlet) of the dunes and shoreline as 0.6 and 1.5 meters per year from 1938 to 1972. The interval from 1966 to 1972, however, shows accretion of the dune and shoreline at annual rates of 1.71 and 0.15 meter per year, respectively.

The long-term erosion rate determined by aerial photo analysis of the southern North Carolina shoreline is presently being studied. Specific methods and expected reliability of the estimates obtained by the analysis are explained in Dolan, et al. (1979, 1980).

The erosion rate during the BEP study period was estimated from measured changes in above MSL volume and MSL shoreline position. Holden Beach was divided into three reaches, each similar in response to processes and in the degree of variability shown by the plots of volume and MSL intercept change (Apps. C and D, respectively). The three reaches are Lockwoods Folly (profile lines 1, 2, and 3), central (profile lines 4 to 18), and Shallotte (profile lines 19, 20, and 21).

Plots of the change in MSL intercept and above MSL sand volume with each successive measurement (Apps. C and D) give a qualitative indication of the temporal variability of each profile line. Superposition of plots shows many instances during which changes are of opposite sign, even at adjacent profile lines, suggesting that spatial variability is also quite large. Linear regression analysis was used to evaluate the trends in shoreline position and volume with slopes for each profile line given in Table 3. Though a trend could be estabilished in each case, the coefficient of determination

$$R^2 = \frac{SS_R}{SS_T} = \frac{\text{sum of squares due to regression}}{\text{total sum of squares (corrected for mean)}}$$

was significant at the 95-percent level in only six of the profile lines along the central reach, indicated in Table 3. The proportion of total variation about the mean explained by linear regression is not significant at the 95-percent confidence level for the remaining profile lines.

The annual rates of change predicted by the regression lines of MSL position and unit volume are generally more extreme near the inlets than along the central reach. Since profile lines are almost evenly spaced along the beach, changes may be estimated by averaging the parameter of interest along the selected reach. The generalizations developed by this method should be applied

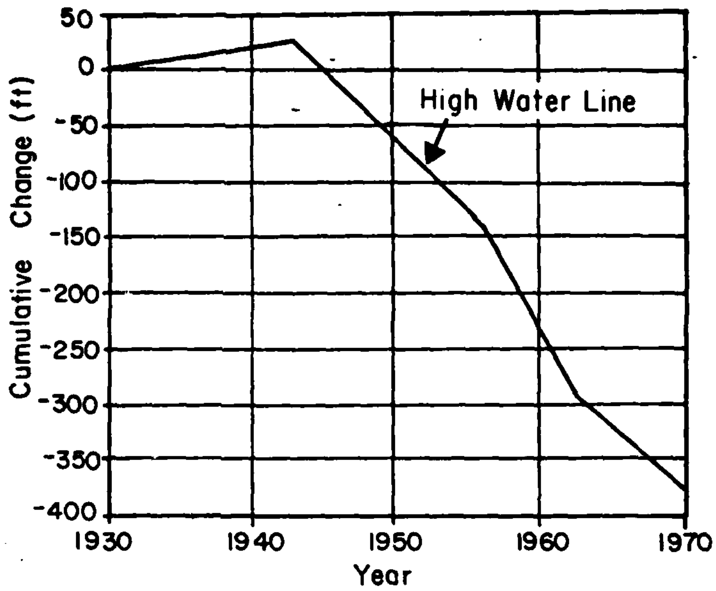


Figure 13. Cumulative change in high water line position east of profile line 4 (U.S. Army Engineer District, Wilmington, 1973).

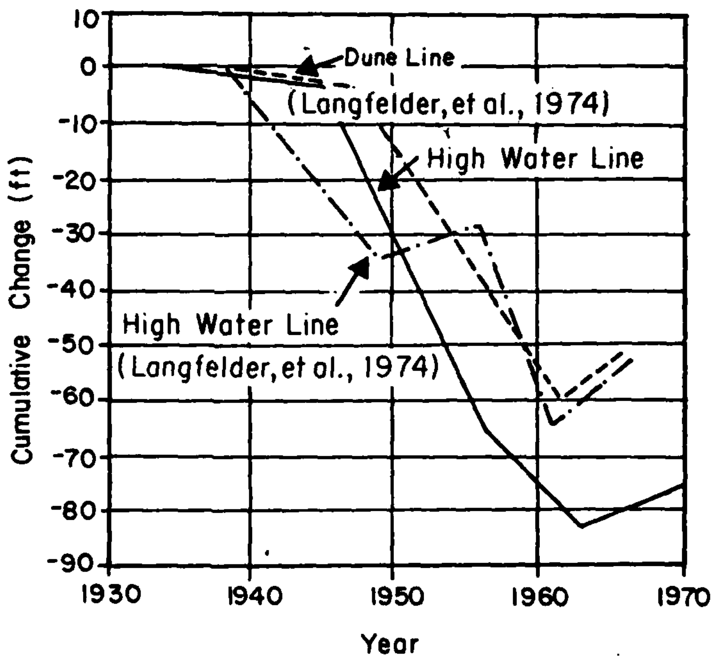


Figure 14. Comparison of cumulative change in position of high water line and dune line west of profile line 4 from aerial photo analysis (U.S. Army Engineer District, Wilmington, 1973). Solid line from Corps of Engineers study.

Table 3. Linear regression coefficients for changes in MSL intercept and above MSL sand volume (from Apps. C and D, respectively).

Reach and profile line No.	Shoreline position slope (m/yr)	Coefficient of determination (R^2)	Unit volume change slope (m^3/m/yr)	Coefficient of determination (R^2)	Mean MSL position slope (m/yr)	Mean unit volume change (m^3/m/yr)
Lockwoods Folly						
1	-5.29	0.22[2]	-3.59	0.21[2]		
2	9.12	0.46[2]	20.18	0.39[2]	3.71	9.32
3	7.30	0.65[2]	13.32	0.70[2]		
Central						
4	2.29	0.13[1]	2.67	0.22[2]		
5	1.20	0.04	0.08	-0-		
6	0.79	0.02	1.83	0.12[1]		
7	1.86	0.14[1]	3.00	0.21[2]		
8	-0.85	0.04	-2.68	0.11[1]		
9	0.38	-0-	-0.60	0.02		
10	1.72	0.14[1]	-0.69	0.01		
11	1.38	0.07	0.54	0.01	1.18	-0.44
12	1.42	0.08	0.38	-0-		
13	1.18	0.05	-0.28	-0-		
14	2.11	0.15[1]	0.77	0.02		
15	1.67	0.13[1]	-1.29	0.05		
16	2.45	0.22[2]	0.79	0.01		
17	0.80	0.07	-4.03	0.25[2]		
18	-0.74	0.06	-6.99	0.52[2]		
Shallotte						
19	7.93	0.74[2]	12.87	0.72[2]		
20	-4.04	0.04	-7.93	0.07	5.25	11.53
21	11.87	0.75[2]	30.11	0.88[2]		

[1]Significant at 95 percent confidence level.

[2]Significant at 99 percent confidence level.

only to the central reach, since bars and shoals develop near the inlets and beach nourishment operations greatly complicate the wave and transport regime along those reaches and invalidate the uniformity assumed along the central part of the island. Regression analysis indicates that the MSL shoreline is advancing seaward at slightly greater than 1 meter per year while the above MSL volume is decreasing by nearly 0.5 cubic meter per meter per year. A more thorough sand budget than can be developed from these data would be required to confirm whether the MSL position is growing at the expense of the volume or by addition of sand from a source external from the island. If the former is the case, however, the beach may be getting flatter, a condition that has implications for coastal flooding.

The changes in above MSL volume and in the MSL intercept for each survey period are averaged by reach in Tables 4 and 5. The standard deviation about the mean is also shown to identify periods when erosion or accretion was ubiquitous. The averaging process eliminates the variability between adjacent profile lines which may be caused by measuring across a migrating coastal feature such as a cusp, rip channel, or sandbar. The presence of these can be determined by spacing profile lines more closely than the length scale of the feature itself. The changes in shoreline position and volume were determined on an annual basis by summing the changes for each year. The result is the same as subtracting the shoreline position or volume from its value the previous year. The beginning date of 14 December 1970 and ending date of 3 December 1974 allowed computation of 4 complete years with comparable (within several days) annual intervals. This method yields annual rates of change of +0.15 meter per year and -4.81 cubic meters per meter per year for MSL intercept and volume, respectively. The slope of the first temporal eigenfunction (mean retained) provides another method of determining whether the measured beach profile is gaining or losing volume (Aubrey, 1979). There was no measurable slope in this parameter for any of the profile lines along the central reach indicating that the trend, if any, is not significant over the study period.

The annual spatial variation in the position of the MSL intercept is shown relative to the 4-year mean MSL intercept for that profile line in Figure 15. The horizontal line represents the long-term (Nov. 1970-Dec. 1974) mean position of the MSL intercept measured from the reference monument. The circles are the annual mean, MSL position for each profile line for the year indicated (January to December), and the vertical bar represents one standard deviation in the annual fluctuation. The diagram is arranged from the perspective of an observer at sea looking shoreward. Lockwoods Folly Inlet and profile line 1 are, therefore, to the right. Increases in distance to the MSL shoreline (over the long-term mean) are indicated in the usual sense by the mark above the line. Only the central reach was analyzed in this way because of the extreme variability of the inlet reaches. The sum of the annual means does not exactly equal zero because the long-term mean included profile line measurements taken in November and December 1970. The horizontal line provides a useful reference to compare the annual movement in MSL position. Profile line measurements were evenly distributed during each of the years so no single year biased the long-term mean.

Most of the annual means fall within one standard deviation of the long-term mean. The only exceptions are profile lines 13 (1972) and 4 (1974),

Table 4. Change in above MSL sand volume (m^3/m) averaged over each reach between the dates indicated.

Year	Survey date: Before	Survey date: After	Lockwoods Folly: Mean	Lockwoods Folly: Std. dev.	Central: Mean	Central: Std. dev.	Shallotte: Mean	Shallotte: Std. dev.
1970	12 Nov.	14 Dec.	- 2.60	6.38	9.81	4.44	9.07	11.12
	14 Dec.	14 Jan.	- 7.88	11.87	- 2.11	5.62	12.41	9.85
1971	14 Jan.	8 Feb.	6.37	20.77	-11.04	4.30	- 1.89	7.66
	8 Feb.	9 Mar.	23.95	54.83	- 1.31	4.27	4.59	5.73
	9 Mar.	8 Apr.	-13.17	2.73	5.16	7.38	10.17	8.16
	8 Apr.	10 May	- 7.67	7.65	- 0.66	6.90	1.61	4.61
	10 May	7 June	- 0.42	1.50	6.14	5.55	0.43	5.13
	7 June	9 Aug.	2.38	5.95	5.00	4.10	- 2.20	6.75
	9 Aug.[1]	31 Aug.	11.14	10.11	- 2.17	5.41	2.47	10.57
	31 Aug.	6 Oct.	13.18	13.71	- 4.20	7.73	1.24	20.80
	6 Oct.	14 Dec.	1.27	9.46	- 5.09	10.48	-15.58	20.42
	14 Dec.	3 Jan.	- 5.81	1.46	- 4.69	3.07	- 0.31	2.13
1972	3 Jan.	8 Feb.	4.31	6.71	3.14	3.43	0.83	8.85
	8 Feb.	20 Mar.	- 2.17	7.51	- 4.21	5.64	34.83	77.26
	20 Mar.	13 Apr.	- 5.57	8.06	- 0.11	4.13	-28.50	63.68
	13 Apr.	9 June	- 0.24	3.00	8.05	6.60	-11.56	6.43
	9 June	25 June	- 8.04	2.78	- 5.29	4.39	- 6.52	6.57
	25 June	5 Aug.	-13.16	20.87	6.07	4.45	8.88	13.06
	5 Aug.[1]	29 Sept.	22.29	29.30	7.89	5.04	7.64	11.65
	25 Sept.[1]	11 Dec.	4.40	18.21	- 8.71	3.52	1.91	4.81
	11 Dec.	15 Jan.	10.35	11.13	0.14	3.93	4.75	10.23
1973	15 Jan.	15 Feb.	- 1.28	8.92	- 2.11	2.84	- 6.64	11.13
	15 Feb.	15 Mar.	1.80	2.90	1.79	3.72	- 0.87	8.11
	15 Mar.	28 Mar.	- 2.17	4.12	- 2.20	4.44	5.92	8.16
	28 Mar.	13 Apr.	- 2.18	4.00	- 8.15	4.62	2.33	4.82
	13 Apr.	14 June	0.34	10.72	8.91	5.38	2.30	7.02
	14 June	12 July	- 1.67	7.35	7.74	3.55	3.07	8.71
	12 July	9 Aug.	- 6.43	4.82	- 1.79	5.09	3.81	4.08
	9 Aug.[1]	8 Oct.	23.63	8.72	- 1.60	9.37[2]	- 8.78	12.33
	8 Oct.	5 Dec.	4.59	6.98	0.57	6.40[3]	0.86	18.10
	5 Dec.	7 Jan.	- 2.02	3.26	- 3.86	7.95[4]	9.21	9.08
1974	7 Jan.	4 Feb.	0.91	12.11	1.85	6.66	3.26	5.39
	4 Feb.	4 Mar.	-13.85	1.26	- 5.79	7.37	4.96	1.02
	4 Mar.	1 Apr.	10.93	9.58	1.05	3.97	1.74	7.26
	1 Apr.	30 May	- 2.01	6.32	4.18	4.83	15.63	1.05
	30 May[1]	16 Aug.	38.25	62.01	1.23	5.08	0.69	13.14
	16 Aug.	30 Sept.	-19.15	20.49	1.96	2.80	9.29	7.80
	30 Sept.	3 Dec.	-14.64	25.23	-15.03	4.25	- 7.40	7.31

[1] Beach nourishment at profile line 2 during interval.

[2] Profile line 11 missing.

[3] Profile lines 11 and 17 missing.

[4] Profile line 17 missing.

Table 5. Change in position of MSL intercept (m) averaged over each reach between the dates indicated.

Year	Survey date		Reach					
			Lockwoods Folly		Central		Shallotte	
	Before	After	Mean	Std. Dev.	Mean	Std. dev	Mean	Std. dev.
1970	12 Nov.	14 Dec.	3.13	13.37	1.49	6.25	5.80	12.35
	14 Dec.	14 Jan.	- 6.63	13.37	2.21	2.75	5.80	2.46
1971	14 Jan.	8 Feb.	1.80	21.17	- 7.21	7.56	3.33	7.88
	8 Feb.	9 Mar.	0.43	9.81	0.56	6.66	6.17	7.77
	9 Mar.	8 Apr.	- 3.70	3.60	- 1.15	6.61	0.37	1.65
	8 Apr.	10 May	-19.10	35.51	0.98	6.11	- 4.67	1.93
	10 May	7 June	6.40	1.22	0.75	5.76	- 4.60	5.70
	7 June	9 Aug.	- 2.80	6.85	0.35	4.72	- 1.30	1.18
	9 Aug.[1]	31 Aug.	13.90	16.89	1.47	3.77	2.30	7.82
	31 Aug.	6 Oct.	1.67	21.84	- 0.71	7.21	- 3.50	10.93
	6 Oct.	14 Dec.	- 0.43	2.45	5.01	7.18	- 5.07	17.56
	14 Dec.	3 Jan.	- 2.90	1.41	- 3.07	3.08	- 1.77	0.50
1972	3 Jan.	8 Feb.	0.70	5.12	- 1.76	3.31	- 2.63	8.65
	8 Feb.	20 Mar.	- 1.07	1.59	- 2.52	3.85	8.50	9.19[2]
	20 Mar.	13 Apr.	0.27	5.54	1.67	3.66	10.27	10.28
	13 Apr.	9 June	0.90	4.87	8.99	7.01	- 9.23	9.35
	9 June	25 June	- 4.20	1.93	- 9.29	7.52	0.47	4.55
	25 June	5 Aug.	-10.77	6.73	- 1.43	7.62	- 6.00	1.70
	5 Aug.[1]	29 Sept.	17.27	14.57	7.89	6.55	3.73	9.58
	29 Sept.[1]	11 Dec.	- 0.77	13.52	1.29	3.39	1.57	11.63
	11 Dec.	15 Jan.	- 4.33	0.50	- 0.39	4.51	4.27	5.49
1973	15 Jan.	15 Feb.	0.67	9.07	0.05	5.90	- 0.60	5.00
	15 Feb.	15 Mar.	0.67	7.91	0.98	5.28	1.47	11.43
	15 Mar.	28 Mar.	- 0.20	4.44	- 5.65	4.62	3.43	4.44
	28 Mar.	13 Apr.	0.20	4.97	- 1.27	6.34	- 0.17	4.72
	13 Apr.	14 June	- 3.73	6.75	- 0.36	5.71	- 1.80	6.70
	14 June	12 July	- 4.23	3.25	1.71	6.48	- 1.30	0.75
	12 July	9 Aug.	0.20	7.99	0.90	5.78	- 0.77	1.78
	9 Aug.[1]	8 Oct.	11.20	5.37	6.70	5.53[3]	1.90	4.24
	8 Oct.	5 Dec.	1.60	1.44	- 4.87	6.66[4]	4.77	9.06
	5 Dec.	7 Jan	- 4.77	3.35	- 1.83	4.94	- 0.67	4.48
1974	7 Jan.	4 Feb.	2.23	8.24	2.53	3.33	2.30	5.04
	4 Feb.	4 Mar.	- 5.13	6.54	- 2.49	6.03	1.13	2.16
	4 Mar.	1 Apr.	9.07	5.41	1.07	3.52	- 0.63	3.42
	1 Apr.	30 May	1.23	11.35	6.76	6.25	18.40	19.22
	30 May	16 Aug.	4.90	10.44	- 3.19	6.47	7.03	3.78
	16 Aug.	30 Sept.	- 4.10	5.30	9.10	6.41	9.20	8.69
	30 Sept.	3 Dec.	0.80	0.90	-13.17	7.90	- 6.23	9.62

[1] Beach nourishment at profile line 2 during interval.

[2] Profile line 21 missing.

[3] Profile line 11 missing.

[4] Profile line 17 missing.

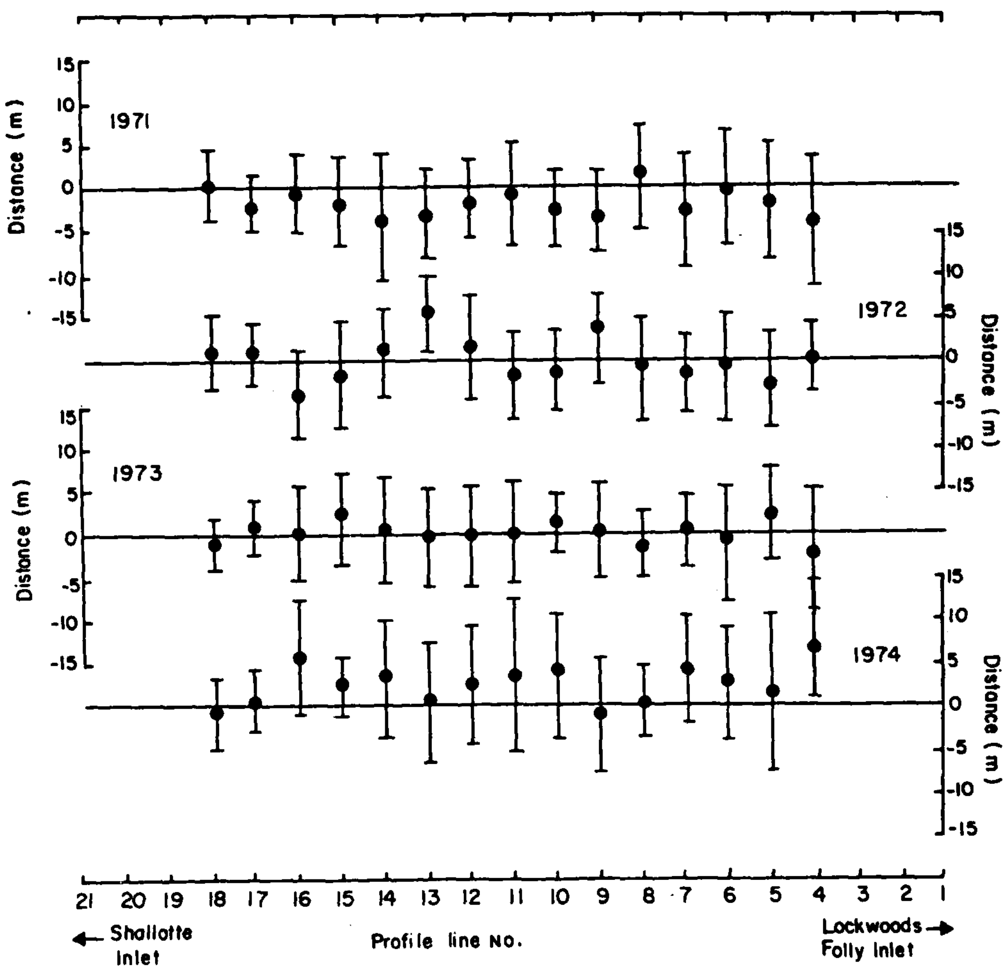


Figure 15. Displacement distance and standard deviation of annual mean, MSL intercept from long-term mean (Nov. 1970-Dec. 1974), MSL intercept at each profile line (1971-74).

both of which show large increases in MSL distance. There is no obvious reason for these radical departures from the long-term mean.

The year 1971 shows a general landward migration of the mean, MSL intercept with increases only at profile lines 8 and 18. During 1972, the mean MSL was more variable, with recession along the eastern half of the island (profile line 9 excepted) and both gains and losses on the western half. The annual mean during 1973 was very near the long-term mean while 1974 shows a marked increase in the MSL shoreline at almost all profile lines.

b. Seasonal Changes. Beaches on the west coast undergo seasonal cycles in response to changing wave and storm conditions with profile shapes characteristic of the summer and winter season. Studies of beach shape have shown that the "winter profile" has almost no berm since steep waves shift the sand offshore to form a series of sandbars parallel to shore. The "summer profile" is characterized by a wide berm and by a smooth offshore profile with no bars except, possibly, in deep water. These seasonal profile shapes are more characteristic of storm and recovery cycles on east coast beaches (Komar, 1976). The length of the Holden Beach profile lines is not sufficient to show offshore sandbars. Seasonal cycles in MSL intercept and above MSL sand volume have been shown on east coast beaches (Goldsmith, Farrell, and Goldsmith, 1974; Everts and Czerniak, 1977; DeWall, Pritchett, and Galvin, 1977; DeWall, 1979; Everts, DeWall, and Czerniak, 1980).

The seasonal cycle is evident in the above MSL sand volume change averaged across the central reach (Fig. 16). The amount of erosion or accretion for each year was obtained by summing the volume change for the dates and years indicated and averaging these seasonal values for profile lines 4 through 18. This analysis shows that sand is removed from the beach, either toward the inlets or to below MSL, during the autumn and winter and replaced during spring and summer. The direction and degree of motion, whether longshore or onshore-offshore, were not determined from these data.

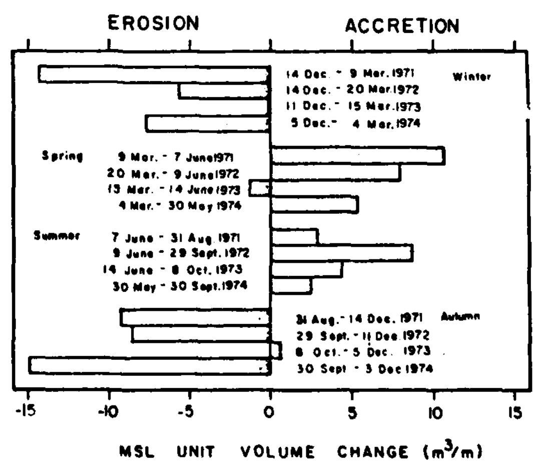


Figure 16. Seasonal changes in above MSL volume averaged over the central reach.

Empirical eigenfunction analysis has been used successfully to show seasonal trends from beach profile data collected at Torrey Pines Beach, California (Aubrey, 1979). A similar analysis applied to the Holden Beach data set indicates a clear seasonal cycle in the first temporal demeaned eigenfunction for only four (profile lines 8, 10, 12, and 16) of the profile lines (Fig. 17).

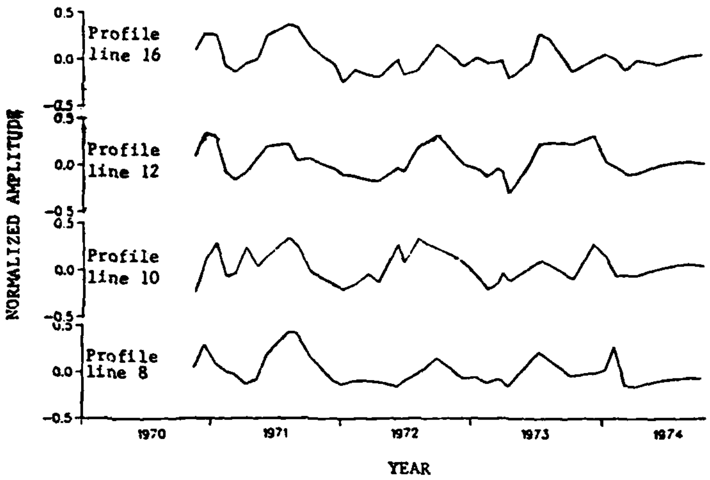


Figure 17. Seasonal trend in selected beach profiles, shown by the first temporal eigenfunction with the mean removed.

c. Short-Term Changes.

(1) Dredging Operations. The Wilmington District has performed maintenance dredging along the Atlantic Intracoastal Waterway (AIWW) for a number of years. Holden Beach residents speculated that continued dredging in the Lockwoods Folly channel exacerbated the already severe erosion problem at that end of the island. They argued that disposal of the material on the mainland shore removed a source of sand which, under certain conditions, protected or even nourished the island beach, so since 1967 the dredged material has been deposited along the east end of Holden Beach. Dredging operations with material being pumped across the island and deposited near profile line 2 are shown in the 1971 aerial photo in Figure 2.

Dredging records are incomplete for the BEP study period. Table 6 provides dredging dates with the available volumes either given or estimated. There were other reported dredging periods when material was not deposited on Holden Beach.

Table 6. Dredging record at Lockwoods Folly Inlet during BEP study.

Year	Dredging period	Volume (m^3)	Annual volume (m^3)
1971	Aug.[1]		82,690
1972	28 Aug.-26 Sept. 28 Nov.-11 Dec.	45,870 21,410[2]	
1973	23 Aug.-5 Sept.	21,410[2]	83,050
1974	6 - 22 June	46,330	41,760[3] 70,930[3]

[1]As shown in August 1971 aerial photo (Fig. 2).
[2]Estimated, based on dredging rate of 1,530 cubic meters per day.
[3]Annual volume from two contracts.

The results of the beach fill are evident in the volume and MSL intercept changes observed at profile line 2 (Apps. C and D), and also in the averaged beach changes along the Lockwoods Folly reach (Tables 4 and 5). The effect of the fill appears to be temporary since the mean change in Lockwoods Folly reach is a loss except during nourishment periods.

A series of 16 sandbag groins, placed along the east end of the island in December 1972, were monitored approximately monthly until July 1974, using beach profile measurements and aerial photos (Machemehl, 1977). Evidence indicates the program did little to retard erosion. There was no sign of the groins along the beach in October 1980.

(2) Storms. A tabulation of storms revealed that 71 hurricanes which may have affected the study area occurred along the southern North Carolina coast from 1804 to 1971, an average of 1 hurricane every 2.4 years (U.S. Army Engineer District, Wilmington, 1973). Complete records of coastal impacts do not exist for the earlier storms. Hurricane Hazel, which occurred in October 1954, has been identified as the "most destructive and damaging storm that has struck the North Carolina coast in over 50 years" (U.S Army Engineer District, Wilmington, 1973, p. A-17). The storm made landfall near the North Carolina-South Carolina State line and caused a storm surge of 4.6 meters above MSL or 2.1 meters above the average topographic elevation of the barrier island masses. Damages to Long Beach, Holden Beach, and Ocean Isle Beach were estimated in 1954 at $8.76 million (U.S. Army Engineer District, Wilmington, 1973).

East coast storms which may have affected the BEP study period are given in Table 7. The wind events were selected from observations at Wilmington, North Carolina (Fig. 1), and represent periods when the recorded velocity was greater than 10 meters per second for 4 consecutive hours. Water level records, available for most of the study period, were also taken at Wilmington. The 27 storms caused a net loss of sand volume over the central reach. It is evident that not all of the storms caused

Table 7. North Carolina coastal storms, 1970-74.

Year	Storm date	Survey dates		Volume change (m^3/m) and standard deviation by Reach			Information Source[1]	Remarks
		Before	After	1-3 Lockwoods Folly	4-18 Central	19-21 Shallotte		
1970	22 Oct.	15 Oct.	10 Nov.	---[2]	---[2]	---[2]	1	
	26 Oct.	15 Oct.	10 Nov.	---[2]	---[2]	---[2]	1	
	17 Dec.	14 Dec.	14 Jan.	- 7.88/11.87	- 2.11/ 5.62	12.41/ 9.85	1	
	31 Dec.	14 Dec.	14 Jan.	- 7.88/11.87	- 2.11/ 5.62	12.41/ 9.85	2	
1971	27 Jan.[3]	14 Jan.	8 Feb.	6.37/20.77	-11.04/ 4.30	- 1.89/ 7.66	5	
	13 Feb.	8 Feb.	9 Mar.	23.95/54.83	- 1.31/ 4.27	4.59/ 5.73	5	
	4 Mar.	8 Feb.	9 Mar.	23.95/54.83	- 1.31/ 4.27	4.59/ 5.73	5	
	23 Mar.	9 Mar.	8 Apr.	-13.17/ 2.73	5.16/ 7.38	10.17/ 8.16	1	
	26-28 Mar.	9 Mar.	8 Apr.	-13.17/ 2.73	5.16/ 7.38	10.17/ 8.16		
	6-7 Apr.	9 Mar.	8 Apr.	-13.17/ 2.73	5.16/ 7.38	10.17/ 8.16	1	Typical northeaster
	27-28 Aug.	9 Aug.	31 Aug.	11.14/10.11	- 2.17/ 5.41	2.47/10.57	1,3,4	Tropical Storm Doria
	13 Sept.	31 Aug.	6 Oct.	13.18/13.71	- 4.20/ 7.73	1.24/20.80	1,4	Tropical Storm Heidi
	30 Sept.-4 Oct.	31 Aug.	6 Oct.	13.18/13.71	- 4.20/ 7.73	1.24/20.80	1,3,4,5	Hurricane Ginger
1972	4 Feb.	3 Jan.	8 Feb.	4.31/ 6.71	3.14/ 3.43	0.83/ 8.85	1	Typical northeaster
	19 Feb.	8 Feb.	17 Mar.	- 2.17/ 7.51	- 4.21/ 5.64	34.83/77.26	1,5	
	19 Mar.	8 Feb.	17 Mar.	- 2.17/ 7.51	- 4.21/ 5.64	34.83/77.26		
	11-27 May[3]	13 Apr.	9 June	- 0.24/ 3.00	8.05/ 6.60	-11.56/ 6.43	2	
	21 June	9 June	25 June	- 8.04/ 2.78	- 5.29/ 4.39	- 6.52/ 6.57	4	Hurricane Agnes
1973	9-12 Feb.	15 Jan.	15 Feb.	- 1.28/ 8.92	- 2.11/ 2.84	- 6.64/11.13	1,2,5	
	16-22 Mar.	15 Mar.	28 Mar.	- 2.16/ 4.12	- 2.20/ 4.44	5.92/ 8.16	1,2,5	
	4 Apr.[3]	28 Mar.	13 Apr.	- 2.18/ 4.00	- 8.15/ 4.62	2.33/ 4.82		
	10 Apr.	28 Mar.	13 Apr.	- 2.18/ 4.00	- 8.15/ 4.62	2.33/ 4.82		
	27 Apr.[3]	13 Apr.	14 June	0.34/10.72	8.91/ 5.38	2.30/ 7.02	5	
	28 May[3]	13 Apr.	14 June	0.35/10.72	8.91/ 5.38	2.30/ 7.02	5	
	26 Oct.	8 Oct.	5 Dec.	4.59/ 6.98	0.57/ 6.40	0.86/18.10	1,4	
1974	22 Feb.	4 Feb.	4 Mar.	-13.85/ 1.26	- 5.79/ 7.37	4.96/ 1.02	5	
	30-31 Mar.	4 Mar.	1 Apr.	10.93/ 9.58	1.05/ 3.97	1.74/ 7.26	1	

[1]Information sources are: 1, Birkemeir (1979); 2, Baker (1978); 3, U.S. Army Engineer District, Wilmington (1973); 4, Neumann, et al. (1978); 5, National Oceanic and Atmospheric Administration (1971-74).
[2]Volume change data not available.
[3]Indicates an erosion or accretion event.

erosion. There was a net gain in sand volume over each of the inlet reaches during these storm periods.

High water levels and wind-generated waves combine to cause beach erosion. Holden Beach, exposed southward and partially protected from the southeast by Frying Pan Shoals, is not affected by northeast storms as much as the other parts of the coast exposed eastward. However, high water levels and strong winds from the southwest-to-southeast direction can be expected to cause erosion.

Ten erosion or accretion events were selected from 14 events identified (6 erosion and 8 accretion) for close study in an attempt to distinguish the conditions which cause erosion from those associated with accretion. The criterion for selection was that the standard deviation of the volume change along the central reach was less than the mean during that interval. Two of each event occurred during identified storm periods (Table 7, footnote 3). The events are presented in order of the greatest net volume loss and gain.

(a) 30 September-3 December 1974. The most severe erosion event of the entire study period was recorded during the last survey of the program. A sand loss was recorded at all profile lines except for profile line 3, with a maximum loss at profile line 2 (-42.7 cubic meters per meter). Maximum and minimum losses in the central reach were -21.42 and -8.03 cubic meters per meter calculated at profile lines 14 and 4, respectively. The wind record during the interval (Fig. 18) showed no unusual events to account for such a change, and no visual wave observations or sea level data were available to document conditions during the interval.

(b) 14 January-8 February 1971. Wind conditions and relative water levels recorded at Wilmington are shown in Figure 19; visual wave observations are given in Table 8. This interval had strong winds occur about 27 January offshore with a strong longshore component to the east. The highest water level during the interval occurred just before this date. No unusual conditions were indicated in wave observations, which were available for only about 30 percent of the time early in the interval. Erosion was general along the central reach with a maximum and minimum of -17.83 and -5.46 cubic meters per meter at profile lines 7 and 8, respectively. This observation at adjacent profile lines emphasizes the longshore variability in erosion. Observed conditions during this erosion period did not appear to be substantially different from those during periods of accretion, which suggests that water level and wind conditions measured at Wilmington are not well correlated with changes at Holden Beach.

(c) 29 September-11 December 1972. No storms or particular events during this interval appeared solely responsible for the erosion (Fig. 20). However, several wind events were persistent for several days, and these can be visually correlated with higher water levels. Onshore winds occurred 19-22 November and again 25-28 November; such winds may pile water against the coast to produce high water levels and generate local waves which cause erosion. Erosion during this interval resulted in a sand loss ranging from -14.2 to -1.8 cubic meters per meter at profile lines 9 and 5, respectively. During the same interval, both inlet reaches experienced a net gain in sand volume.

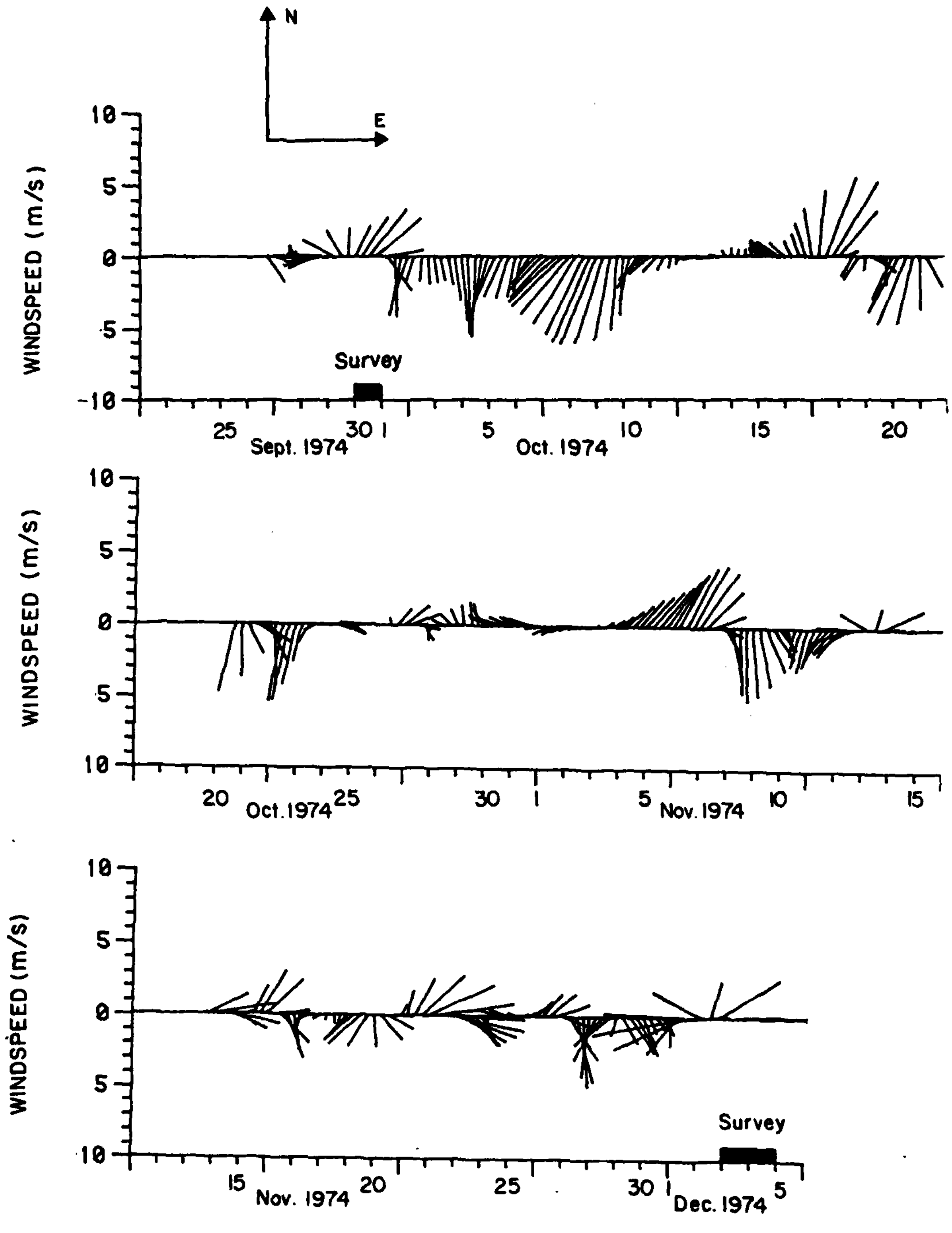


Figure 18. Wind velocity recorded at Wilmington, North Carolina, between 30 September-3 December 1974.

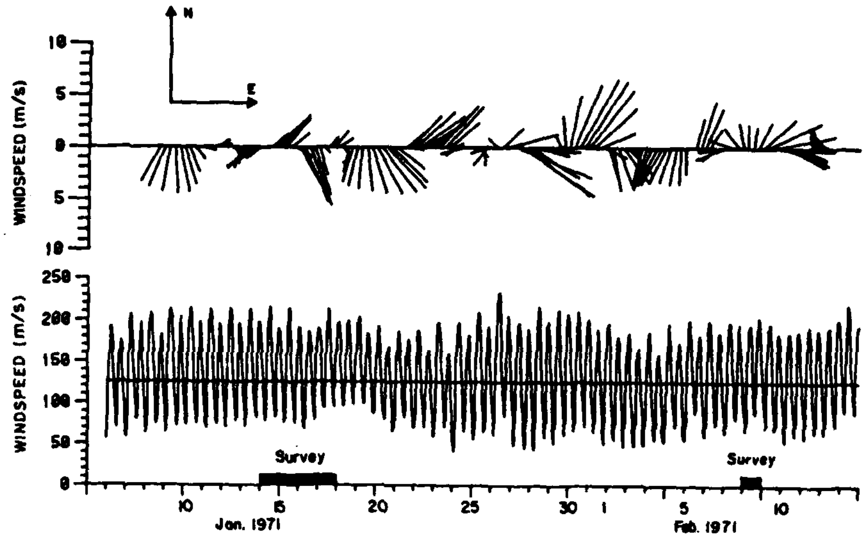


Figure 19. Wind velocity and water level during erosion event recorded at Wilmington, North Carolina, between survey dates 14 January-8 February 1971.

Table 8. Visual wave observations of erosion and accretion events at Holden Beach during BEP study.

Event	Wave direction from				Energy flux toward			Net	Gross	Pct complete
	90° Offshore	Calm	72° (left)	108° (right)	Onshore	West	East			
Erosion										
30 Sept.- 3 Dec. 1974[1]										
14 Jan. - 8 Feb. 1971	6	0	0	6	7.76	0	-12.52	-12.52	20.28	0.29
29 Sept.-11 Dec. 1972	22	1	23	3	192.90	63.84	-18.35	45.49	275.09	64
28 Mar. -13 Apr. 1973	13	0	2	1	263.08	6.66	- 5.66	1.00	275.40	100
9 June -25 June 1972	8	0	3	2	73.54	35.76	-16.59	19.17	125.88	81
Accretion										
12 Nov. -14 Dec. 1970[1]										
13 Apr. -14 June 1970	44	0	10	3	486.13	39.82	-44.64	- 4.82	570.56	90
13 Apr. - 9 June 1972	28	0	21	4	165.81	90.80	-15.07	75.73	105.87	91
5 Aug. -29 Sept.1972	17	0	18	0	225.08	76.50	0	76.50	301.59	64
15 June -12 July 1973	14	1	11	2	53.19	38.69	-12.14	26.05	104.52	97

[1]No visual wave data.

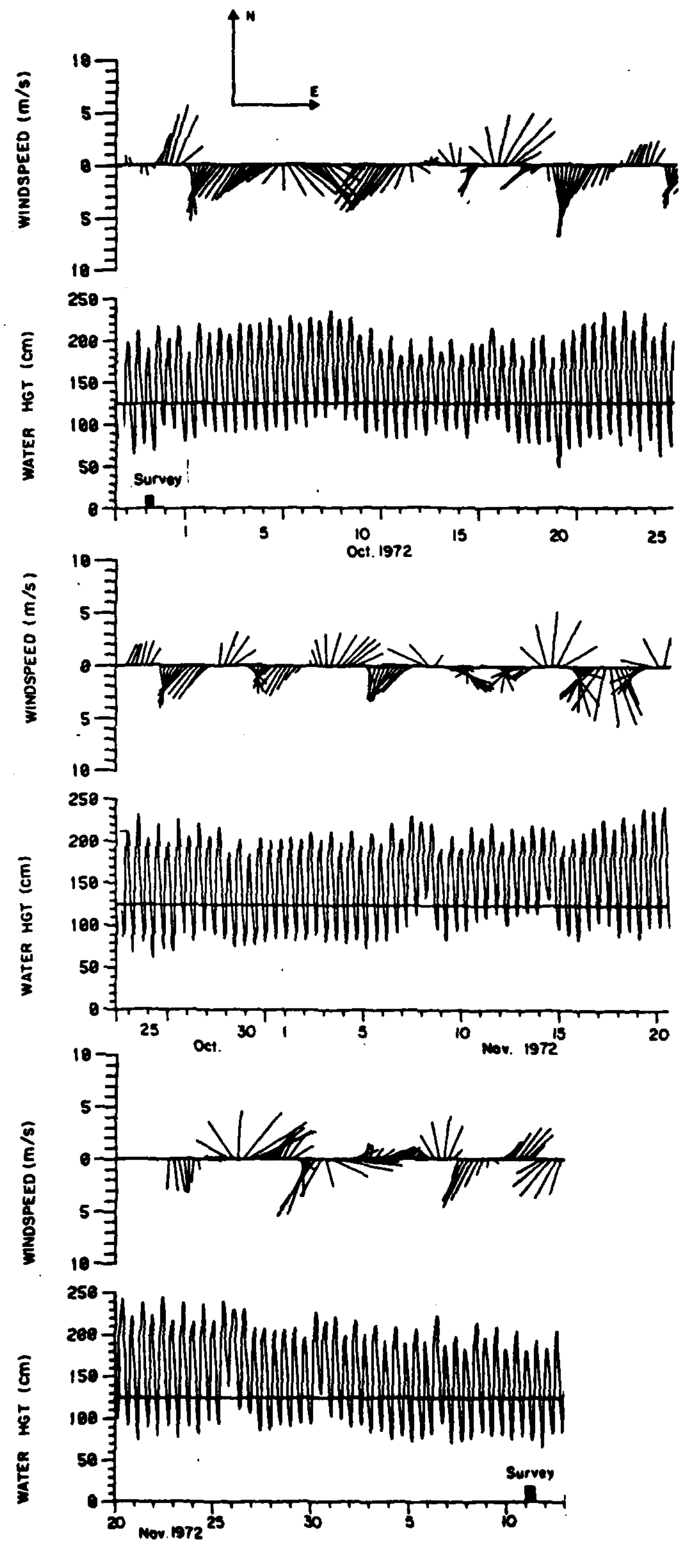


Figure 20. Wind velocity and water level recorded at Wilmington, North Carolina, 29 September-11 December 1972.

(d) 28 March-13 April 1973 and 9-25 June 1972. Wind and water level records for the remaining two erosion periods are shown in Figures 21 and 22. Both intervals showed instances of relatively strong onshore winds combined with high water levels. Both also exhibited strong longshore winds which may be instrumental in developing obliquely incident waves or wind-driven currents which increased littoral transport.

(e) 14 November-14 December 1970. The largest mean increase in volume occurred along the central reach during this interval. Winds were mainly onshore but never severe (Fig. 23). The strongest winds (about 7.6 meters per second) occurred from the north on 25 November during a period of low water level. The highest water during the interval occurred about 30 November to 1 December during light and variable winds. The increase in sand volume along the central reach was general during the interval with maximum and minimum of 17.6 and 1.1 cubic meters per meter at profile lines 7 and 17, respectively. In spite of the large net gain, profile lines 1 and 2 experienced a loss of sand.

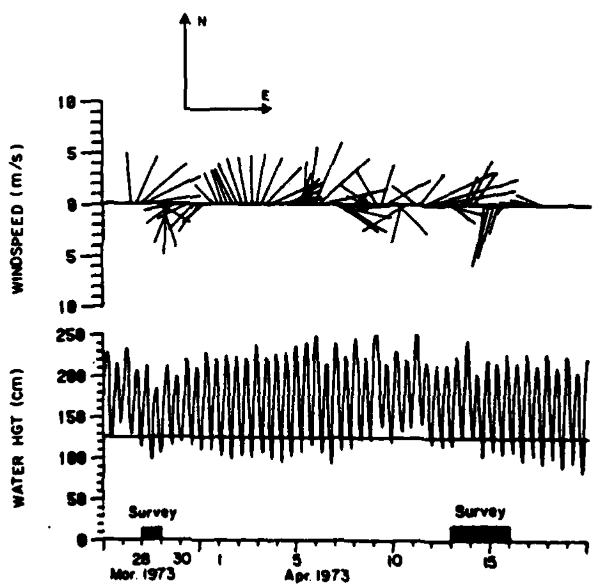


Figure 21. Wind velocity and water level recorded at Wilmington, North Carolina, 28 March-13 April 1973.

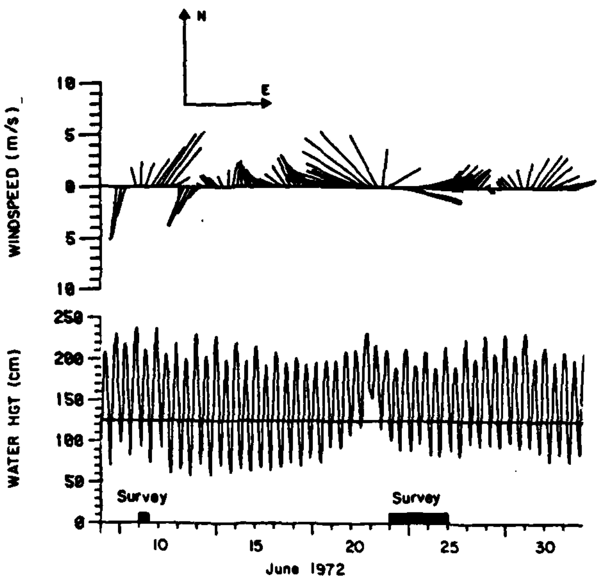


Figure 22. Wind velocity and water level recorded at Wilmington, North Carolina, 9-25 June 1972.

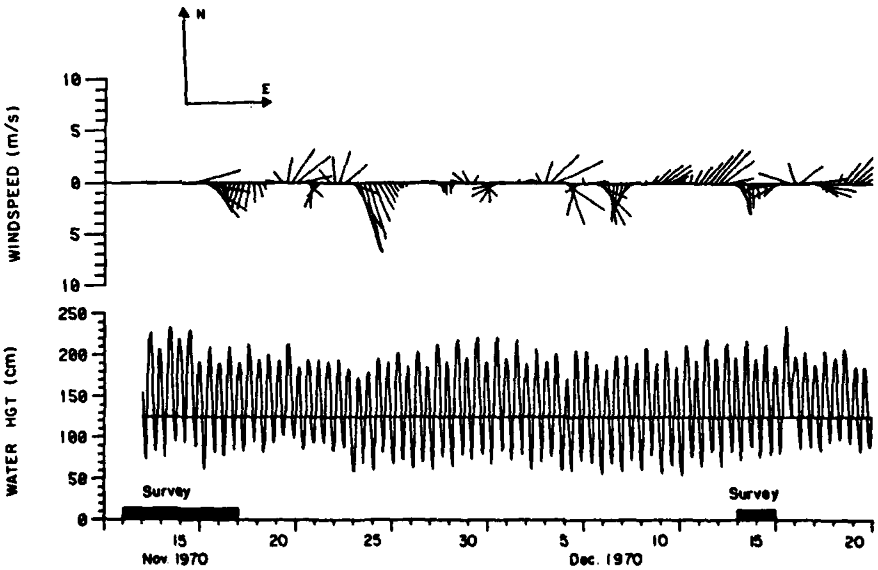


Figure 23. Wind velocity and water level recorded at Wilmington, North Carolina, 12 November - 14 December 1970.

(f) 13 April-14 June 1973. Winds during almost the entire interval were onshore with several instances of strong winds and high water levels (Fig. 24), which occurred 27 April and again 28 May (Table 7). During other periods, however, strong onshore winds were associated with relatively low water. The 10 days before the final survey showed steady onshore winds at a maximum of 3.5 meters per second. Accretion was general along the central reach except at profile lines 15 and 18 which showed slight volume losses. The maximum gain of 19.0 cubic meters per meter occurred at profile line 4.

(g) 13 April-9 June 1972. Onshore winds occurred during most of the interval with strong offshore winds occurring about 26 May (Fig. 25). Water levels were high during strong onshore winds 14 May, but for 5 of the 7 days before the final survey, water was low and onshore winds were gentle. Maximum and minimum volume changes were 19.7 and -4.1 at profile lines 17 and 5, respectively. Erosion was general along the Shallotte reach.

(h) 5 August-29 September 1972 and 14 June-12 July 1973. The remaining two accretion periods showed light onshore or variable winds during several days before the final survey (Figs. 26 and 27).

2. Spatial Variability.

Shoreline and volume changes along Holden Beach occur much more rapidly and to a greater degree in the inlet reaches than along the central reach (Tables 4 and 5). The variability is apparently associated with the flow and transport processes through the inlet. Systematic migrating wavelike features were inferred by Everts, DeWall, and Czerniak (1980) to exist along Ludlam Beach, New Jersey. These features, observed from a 10-year record of beach profile measurements, apparently remain intact near inlets and while traversing groin fields. The presence of migrating topography on Holden Beach was tested using the method of these authors. The results were negative. It is possible that migrating features exist but are transparent on an annual time scale.

Changes in the MSL shoreline position, compared by successive surveys (Fig. 28), suggest migrating features during several surveys (e.g., 15 Feb.-28 Mar. 1972, etc.). The effects of dredge fill on the MSL shoreline change are clearly shown in the 8 February 1971, 31 September 1971, and 29 September 1972 measurements. Dates along the right of Figure 28 are those of the later survey used to determine the change. The observed features, if real, may have been caused by migrating rhythmic topography such as sandbars or cusps. Migration rates varied from 17 to 30 meters per day.

The mean beach slope measured at MSL along Holden Beach increases westward along the central reach from a value of 1:30 at profile line 5 to 1:20 at profile line 14 (Fig. 29). Though the difference is not great, in the absolute sense, it is statistically significant (at $t_{0.025}$ level) and reflects alongshore differences in beach conditions. These differences could be caused by varying energy, possibly due to wave alterations over bathymetric features not seen in this study or by inlet modification. Longshore grain-size information was not available to test for systematic

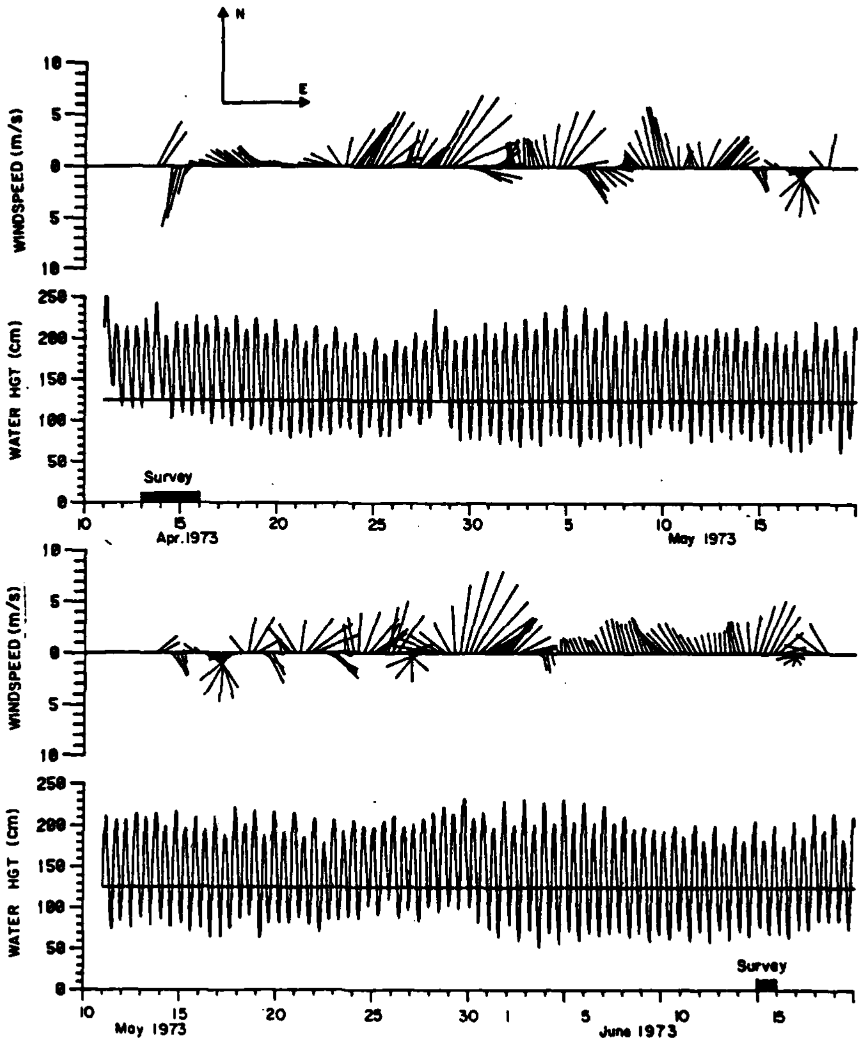


Figure 24. Wind velocity and water level recorded at Wilmington, North Carolina, 13 April-14 June 1973.

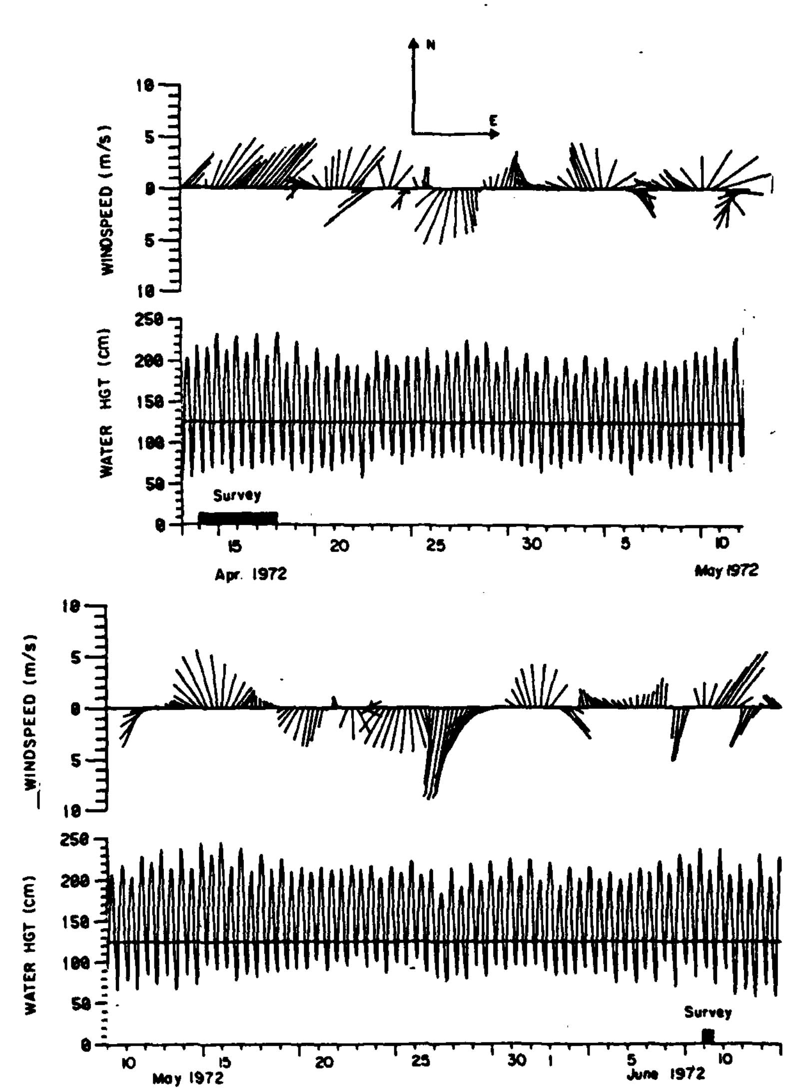


Figure 25. Wind velocity and water level recorded at Wilmington, North Carolina, 13 April-9 June 1972.

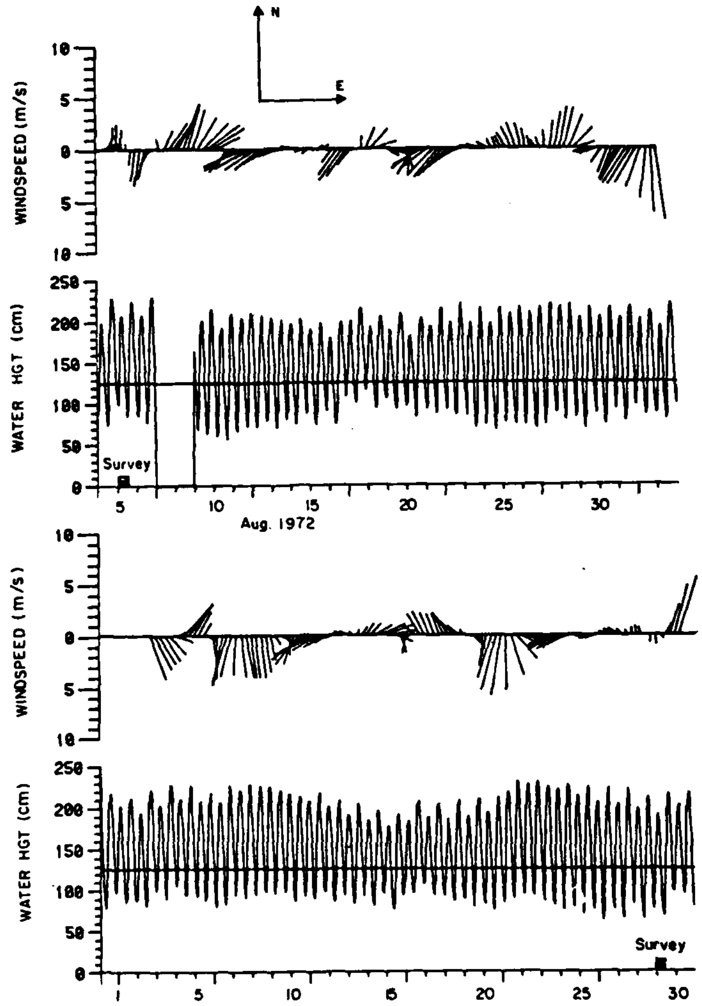


Figure 26. Wind velocity and water level recorded at Wilmington, North Carolina, 5 August-29 September 1972.

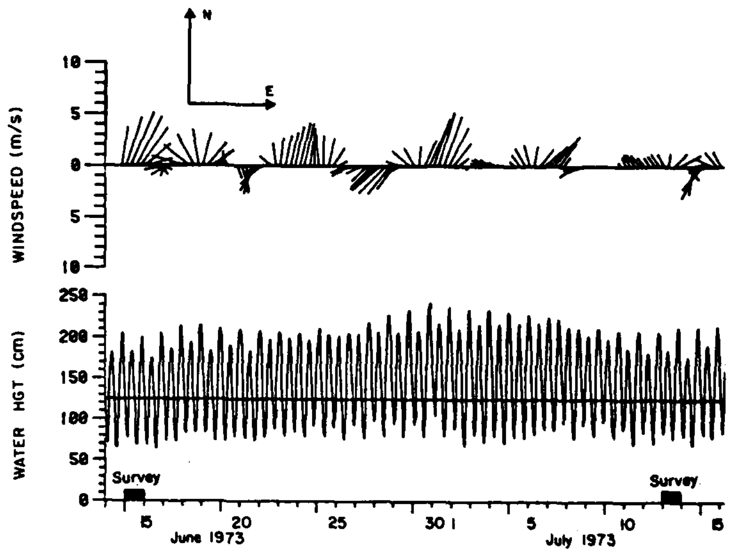


Figure 27. Wind velocity and water level recorded at Wilmington, North Carolina, 14 June - 12 July 1973.

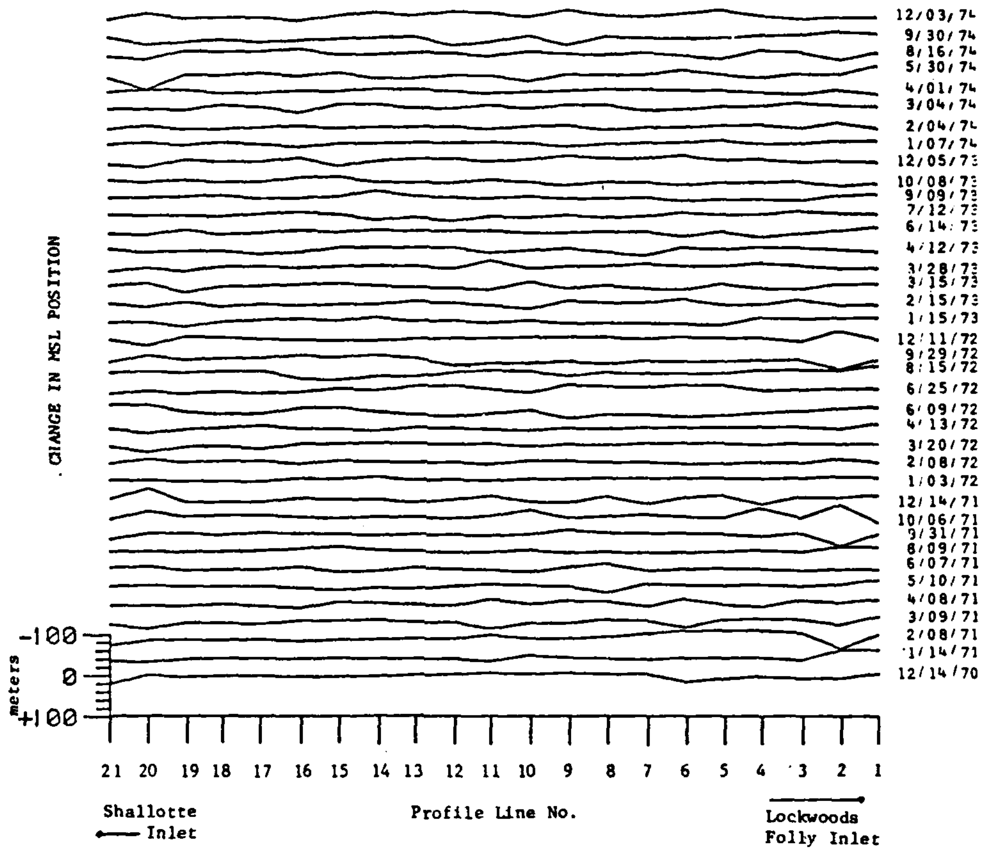


Figure 28. Change in MSL intercept along Holden Beach on successive survey dates. Perspective is that of observer looking northward from offshore. Increase in MSL position is seaward.

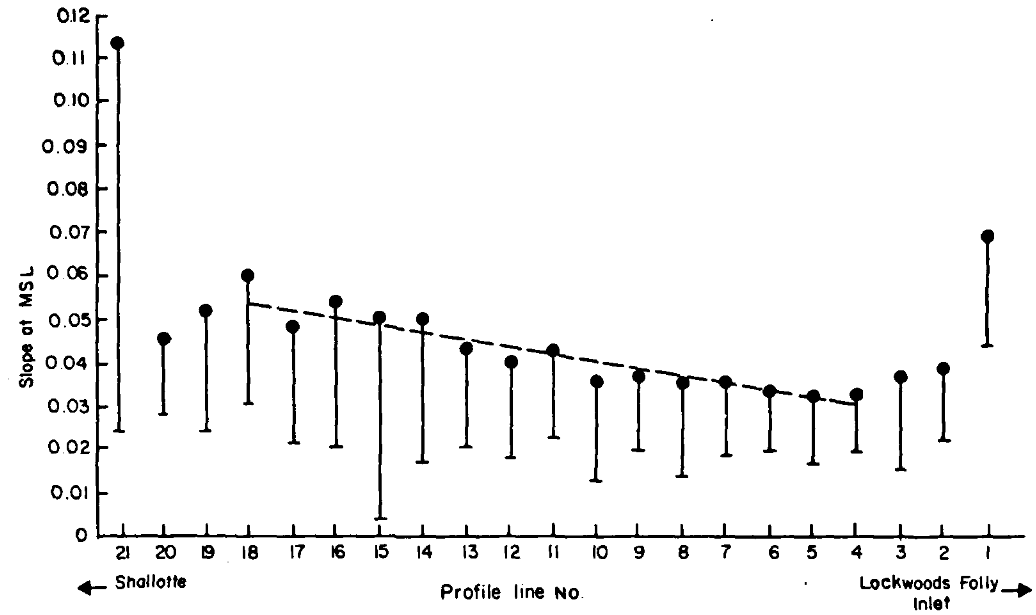


Figure 29. Beach foreshore slope averaged over the study period. Vertical lines are one standard deviation below the mean. Linear trend is the regression, by eye, of the means along the central reach.

variations in that parameter. The slopes of profile lines nearest the two inlet throats (profile lines 1 and 21) show the greatest slope of the study area. The mean slopes at profile lines 2 and 3 have been artificially altered by the beach fill operation.

V. DISCUSSION

1. Profile Changes.

Holden Beach, exposed toward the south and partially protected from large waves from the east by Frying Pan Shoals, is spared the severe erosion caused by east and northeast storms, which arrive along the North Carolina coast mainly during the autumn and winter months. These storms remove large amounts of sand from beaches along the Outer Banks and those shorelines exposed toward the east.

The relative position of the annual mean, MSL intercept (Fig. 15) reflects the number of storm occurrences during the year of measurement (Table 7). The erosion observed over 1971 took place during the year with the largest number of identified storm events, while the increase in MSL intercept over 1974 is correlated with the fewest storms. Changes in sand volume and MSL intercept show extreme variability along the three profile lines comprising each inlet reach, but both have resulted in considerable increases. The limit of significant influence of the inlets, if such exists, has not been determined by these studies. The selection of the inlet reaches, however, provides a convenient separation point based on demonstrated variability. These two measurements are also quite variable along the central reach, but regression analysis and evaluation of the annual change show the MSL position to be extending seaward while the volume decreases. The total annual loss in volume along the central reach (rate of volume change times total length) is approximately balanced by the gains at the two inlet reaches. A similar computation using the regression estimates indicates the volume gains at the inlets are each 3 to 4 times greater than the loss along the central reach. The island appears to be gaining sand volume at the ends while losing volume along the center. The MSL intercept is also progressing seaward more rapidly at the inlet areas. Plots of the actual beach profiles were compared for 14 December 1970 and 4 December 1974. Though possibly not indicative of the entire 4-year span, each set of measurements was taken after a storm (Birkemeier, 1979) so the general beach condition may be comparable. The earlier profiles were characterized by steep foreshore slopes and a backshore area that was convex upward. This was backed by the coastal dune, present in both surveys. The 4 December 1974 profiles showed an offshore bar along most of the central reach with a backshore concave upward, a condition more typical of the storm profile. A considerable volume of sand was removed above MSL and deposited in the offshore bar while the MSL intercept was extended seaward. The actual volume change at the -0.9-meter MSL datum appears to be very small, but the beach face was considerably lowered and extended. If the long-term change in the central reach is toward a lower backshore and extended foreshore, the island may be developing a greater susceptibility to dune erosion by direct wave attack during a storm accompanied by high water and large waves. Future studies of beach volume changes should extend farther into the offshore zone to measure the storage of sand in bars. The rates of change of both MSL intercept and above MSL volume measured here

are small compared to the short-term variability so the direction of the trend, if any, is not clearly shown by this data set. A longer record may be necessary to establish a convincing trend.

The seasonal nature of the above MSL volume was shown in Figure 16. The material removed from the beach during the autumn and winter is apparently replaced (or nearly so) during spring and summer. Extending the profile lines below MSL would allow determination of the offshore changes which have been shown to be important in the beach process. It is possible that the volume change of an extended profile line measured relative to some below MSL datum would be zero if material removed from the beach is stored in the offshore within the range of profile line measurement. Empirical eigenfunction analysis is very useful in showing the regions where changes in beach shape take place. Aubrey (1979) demonstrated that the second temporal eigenfunction showed removal of beach material from onshore and storage in the offshore zone at Torrey Pines Beach. Unless profile line measurements are taken with the method of analysis in mind, it is only fortuitous that a "higher order" analysis technique, which is more powerful and sophisticated, will provide additional insights. The application of empirical eigenfunctions to the Torrey Pines data was fruitful because the study was designed, in part, to develop and test the method. Empirical eigenfunctions did not provide insights into Holden Beach processes that were not available through more traditional and straightforward analysis methods, but the reasons mav be due more to the limitations of the data than to the technique. Though not useful for the Holden Beach data, there are indications that empirical eigenfunctions will be helpful in the interpretation of temporal and spatial variability of other data in this series.

The results of this study suggest that Holden Beach has at least three separate systems to be investigated and interrelated in order to understand processes, such as differences in response to environmental forces (erosion rates, variability of profile changes, and mean slopes) along the beach. These are the Lockwoods Folly reach (profile lines 1 through 3) the central reach (profile lines 4 through 18) and the Shallotte reach (profile lines 19 through 21). Refraction of waves around shoal area, strong tidal currents, and shifting channels near inlet reaches require special, localized observations.

Changes observed along the central reach were visually correlated with wind and water level records taken at Wilmington. These correlations were not altogether satisfactory because of the location of Wilmington relative to Holden Beach; direct wind and water level observations at the site would have shown a more reliable correlation with beach changes.

The identified erosion events were fairly well correlated with high water levels and strong winds during an observation period. The conditions which cause accretion, however, are not easily identified since high water levels and strong onshore winds occurred during these intervals as well. Accretion events seemed to be correlated with gentle onshore winds occurring for several days before the survey (Figs. 23 to 27). Profile line measurements must be taken more frequently in order to isolate the effects of individual events.

Investigations have shown that considerable beach changes occur below MSL, in and beyond the breaker zone. Sand observed on the upper parts of the beach during summer months may be removed and stored in offshore sandbars or transported alongshore during the stormier periods. Material appears to be removed from Holden Beach on a seasonal cycle; however, during the 4-year period, more was returned to the beach than was removed. The fate of the material lost is uncertain. Direct visual observations of waves during the study period indicate transport from east to west is two to three times greater than from west to east, a direction in opposition to that reported from Long Beach and Yaupon Beach (U.S. Army Engineer District, Wilmington, 1973). The transport from Long Beach and Yaupon Beach was based on a wave refraction analysis which systematically eliminated waves from the east and southeast. The remaining waves caused eastward littoral drift. The Holden Beach estimate, though based on once-daily visual observations, is not complete for the entire period. It is quite possible for large waves from one direction for a single day to overcome the estimated transport of smaller waves for several days. The importance of complete, frequent, and accurate wave observations, which include period, height, and breaker angle, cannot be overestimated for making predictions of transport direction and rate.

2. Civil Engineering Implications.

Before 1973, the east end of Holden Beach was identified as having the highest erosion rate of any beach area in Brunswick County. This severe condition damaged the end of a road and caused the removal of six houses (U.S. Army Engineer District, Wilmington, 1973). The addition of fill material at profile line 2 appears to have been effective in reducing the erosion at the end of the island during the study period. At least 280 000 cubic meters of sand was added to the beach from 1970 to 1974. An increase in sand volume is evident along the east end of the central reach, suggesting that the fill was effective in nourishing that end of the island.

Currently, there are no shore protection structures along the beach which interfere with the transport of sand. The sand loss along the central reach during 1971 and 1974 was relatively great and contributed substantially to the net 4-year loss in that zone which is evident in spite of the fact that the study interval was more quiescent than the long-term mean. More thorough studies should be made before any engineered alterations of the beach in order to resolve the ambiguity in littoral transport rates and direction.

The profile envelopes (App. E) show that the sweep zones of the beach profiles measured at MSL are greatest in the inlet reaches, obtaining magnitudes of more than 3 meters at profile lines 2 and 21. Along the central reach, however, the sweep zones are less than 1 meter. This vertical excursion of the profile must be considered in the engineering design of pipelines and other coastal structures. This study emphasizes the extreme variability of beaches near inlets as opposed to those along unbroken beach segments.

Though washovers have not occurred along Holden Beach since Hurricane Hazel, the central, low-lying part of the island, which is narrow, may become more subject to washovers during storms. Coastal modifications which exacerbate this condition must be avoided.

VI. SUMMARY

A total of 815 profile line surveys were taken at 21 locations along the 13.2-kilometer south-facing shoreline of Holden Beach, North Carolina, from November 1970 to December 1974. The average width of the narrow barrier island is 250 meters, terminated at the east and west end by Lockwoods Folly and Shallotte Inlets, respectively. The profile lines along the beach were evenly spaced with minimum and maximum distances of 565 and 638 meters. Average spacing was 610 meters. This spacing was convenient for calculating total beach sand volume changes since profile distances did not have to be weighted.

The beach profile data were used to determine changes in above MSL sand volume, changes in MSL shore, and profile envelopes. The parameters were analyzed to determine beach changes during the survey period and those caused by individual storms. Additional wave, wind and water level data were provided by visual observation, local wave gages, and from recording devices in Wilmington, North Carolina. Fewer storms than average occurred during the study period for this region, and recorded winds were more moderate.

The beach face was divided into three reaches, based upon the variability of the profile line changes during the study period. The two inlet reaches each contained three profile lines with the remainder in the central reach. The beach slope at MSL along the central reach increased from a value of 1:30 at the east end to 1:17 at the west end. The MSL intercept averaged across the central reach varied from +8.99 meters (9 June 1972) to -13.17 meters (3 December 1974). Linear regression analysis indicates the MSL shoreline is advancing at a rate of 1.18 meters per year while the above MSL volume is decreasing at 0.44 cubic meter per meter per year. The direction of change is supported by analysis on an annual basis though the rates are an order of magnitude different; 0.15 meter per year and 4.8 cubic meters per meter per year, respectively. These estimates should be treated with caution since short term variability is quite large and the coefficient of determination calculated for linear regression is small. Empirical eigenfunction analysis applied to the data did not indicate other systematic modes of variability.

The profile lines in the inlet reaches showed the greatest variability in all calculated parameters. The beach nourishment operation at profile line 2 from 1971 to 1974 was intended to reduce the high erosion rate previously observed at the east end of the island. The approximately 280 000 cubic meters of sand placed on the beach during the study period contributed to the net gains in volume and shoreline position along the Lockwoods Folly reach and may have influenced the beach shape at the east end of the central reach. The Shallotte reach showed even more substantial gains without the benefit of artificial nourishment.

A seasonal trend was evident in the change in above MSL sand volume. Losses occurred during the autumn and winter, and gains were measured during spring and summer. Volume losses along the central reach were greater than gains while the reverse was true for both inlet reaches. The visual wave observations were not complete enough to calculate the magnitude of littoral transport. Estimates of alongshore energy flux suggest, however, that the westward transport is two to three times greater than the eastward transport.

LITERATURE CITED

AUBREY, D.G., "Seasonal Patterns of Onshore/Offshore Sediment Movement," *Journal of Geophysical Research*, Vol. 84, No. C10, Oct. 1979, pp. 6347-6354.

BAKER, S., "The Citizen's Guide to North Carolina's Shifting Inlets," UNC Sea Grant Publication UNC-SG-77-08, North Carolina State University, Raleigh, N.C., Mar. 1977.

BAKER, S., "Storms, People and Property in Coastal North Carolina," UNC Sea Grant Publication UNC-SG-78-15, North Carolina State University, Raleigh, N.C., Aug. 1978.

BALSILLIE, J.H., "Surf Observations and Longshore Current Prediction," TM-58, U.S. Army, Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, Va., Nov. 1975.

BIRKEMEIER, W.A., "Beach Evaluation Program Storm Data Summary," U.S. Army Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, Va., unpublished, July 1979.

BOC, S.J., and LANGFELDER, J., "An Analysis of Beach Overwash Along North Carolina's Coast," Report No. 77-9, Center for Marine and Coastal Studies, North Carolina State University, Raleigh, N.C., 1977.

BRUNO, R.O., and HIIPAKKA, L.W., "Littoral Environment Observation Program in the State of Michigan," *Proceedings of the 16th Conference on Great Lakes Research*, 1974, pp. 492-507 (also Reprint 4-74, U.S. Army, Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, Va., NTIS 777 706).

CARNEY, C.B., and HARDY, A.V., "North Carolina Hurricanes," Weather Bureau, ESSA, U.S. Department of Commerce, Washington, D.C., 1967.

CLEARY, W. J., and HOSIER, P.E., "Geomorphology, Washover History, and Inlet Zonation: Cape Lookout, NC to Bird Island, NC," *Barrier Islands from the Gulf of St. Lawrence to the Gulf of Mexico*, S.P. Leatherman, ed., Academic Press, New York, 1979, pp. 237-171.

DeWALL, A.E., "Beach Changes at Westhampton Beach, New York, 1962-73," MR 79-5, U.S. Army, Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, Va., Aug. 1979.

DeWALL, A.E., PRITCHETT, P.C., and GALVIN, C.J., Jr., "Beach Changes Caused by The Atlantic Coast Storm of 17 December 1970," TP 77-1, U.S. Army, Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, Va., Jan. 1977.

DOLAN, R., et al., "The Reliability of Shoreline Change Measurements from Aerial Photographs," *Shore and Beach*, Vol. 48, No. 4, Oct. 1980, pp. 22-29.

DOLAN, R., et al., "Shoreline Erosion Rates Along the Middle Atlantic Coast of the United States," *Geology*, Vol. 7, No. 12, Dec. 1979, pp. 602-606.

DRAPER, N.R., and SMITH, H., *Applied Regression Analysis*, John Wiley and Sons, Inc., New York, 1966.

EVERTS, C.H., and CZERNIAK, M.T., "Spatial and Temporal Changes in New Jersey Beaches," *Proceedings of the Coastal Sediments '77 Conference, American Society of Civil Engineers*, 1977, pp. 444-459 (also Reprint 78-9, U.S. Army, Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, Va., NTIS A051 578).

EVERTS, C.H., DeWALL, A.E., and CZERNIAK, M.T., "Beach and Inlet Changes at Ludlum Beach, New Jersey," MR 80-3, U.S. Army, Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, Va., May 1980.

GOLDSMITH, V., FARRELL, S.C., and GOLDSMITH, Y.E., "Shoreface Morphology Study, The South End of Long Beach Island, Little Beach Island, and the North End of Brigantine Island," Dames and Moore, Inc., Oct. 1974.

HAYES, M.O., "Barrier Island Morphology as a Function of Tidal and Wave Regime," *Barrier Islands from the Gulf of St. Lawrence to the Gulf of Mexico*, S.P. Leatherman, ed., Academic Press, New York, 1979, pp. 1-27.

KOMAR, P.D., *Beach Processes and Sedimentation*, Prentice-Hall, Inc., Englewood Cliffs, N.J., 1976.

LANGFELDER, L.J., STAFFORD, D., and AMEIN, M., "A Reconnaissance of Coastal Erosion in North Carolina," Department of Civil Engineering Report, North Carolina State University, Raleigh, N.C., 1968.

LANGFELDER, L.J., et al., "A Historical Review of Some of North Carolina's Coastal Inlets," Report No. 74-1, Center for Marine and Coastal Studies, North Carolina State University, Raleigh, N.C., 1974.

LORENZ, E.N., "Empirical Orthogonal Functions and Statistical Weather Prediction," Report No. 1, Statistical Forecasting Project, Department of Meteorology, Massachusetts Institute of Technology, Cambridge, Mass., 1959.

MACHEMEHL, J.L., "An Engineering Evaluation of Low Cost Stabilization Projects in Brunswick County, North Carolina," *Proceedings of the Coastal Sediments '77 Conference, American Society of Civil Engineers*, 1977, pp. 696-715.

MACHEMEHL, J.L. CHAMBERS, M., and BIRD, N., "Flow Dynamics and Sediment Movement in Lockwood Folly Inlet, North Carolina," UNC Sea Grant Publication UNC-SG-77-11, North Carolina State University, Raleigh, N.C., June 1977.

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, Unpublished data, National Climatic Center Wind Recording Station, Wilmington, N.C., 1971-74.

NEUMANN, C.J., et al., "Tropical Cyclones of the North Atlantic Ocean, 1871-1977," U.S. Department of Commerce, National Climatic Center, Asheville, N.C., 1978.

PILKEY, O.H., Jr., NEAL W.J., and PILKEY, O.H.,Sr., *From Currituck to Calabash: Living with North Carolina's Barrier Islands,* North Carolina Science and Technology Research Center, Research Triangle Park, N.C., 1978.

RESIO, D.T., et al., "Systematic Variations in Offshore Bathymetry," *Journal of Geology,* Vol. 85, 1977. pp. 105-113.

SHEPARD, F.P., *Submarine Geology,* Harper and Row, New York, 1963.

SZUWALSKI, A., "Littoral Environment Observation Program in California, Preliminary Report," MP 2-70, U.S. Army, Corps of Engineers, Coastal Engineering Research Center, Washington, D.C., Feb. 1970.

THOMPSON, E.F., "Wave Climate at Selected Locations Along U.S. Coasts," TR 77-1, U.S. Army, Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, Va., Jan. 1977.

U.S. ARMY, CORPS OF ENGINEERS, COASTAL ENGINEERING RESEARCH CENTER, *Shore Protection Manual,* 3d ed., Vols. I, II, and III, Stock No. 008-022-00113-1, U.S. Government Printing Office, Washington, D.C., 1977, 1,262 pp.

U.S. ARMY ENGINEER DISTRICT, WILMINGTON, "General Design Memorandum, Phase I, Hurricane Wave Protection and Beach Erosion Control, Brunswick County, North Carolina, Beach Projects, Yaupon and Long Beach Segments," Wilmington, N.C., 1973.

VINCENT, C.L., et al., "Systematic Variations in Barrier Island Topography," *Journal of Geology,* Vol. 84, 1976, pp. 583-594.

WAHLS, H.E., "A Survey of North Carolina Beach Erosion by Air Photo Methods," Report No. 73-1, Center for Marine and Coastal Studies, North Carolina State University, Raleigh, N.C., 1973.

WINANT, C.D., INMAN, D.L., and NORDSTROM, C.E., "Description of Seasonal Beach Changes Using Empirical Eigenfunctions," *Journal of Geophysical Research,* Vol. 80, No. 15, May 1975, pp. 1979-1986.

APPENDIX A

PROFILE LINE DOCUMENTATION AND PHOTOS

This appendix provides ground photos and monument documentation for each of the 21 profile lines along Holden Beach from Lockwoods Folly Inlet to Shallotte Inlet. The horizontal location of each profile line consists of a monument (e.g., capped galvanized pipe) at three stations along the profile line, reference ties measured to local cultural features (when possible), and third-order survey control providing the geodetic and state-plane coordinates of the monument. The station number (with "+", upper right of monumentation sheet) is the distance in feet along the base line from the monument at profile line 1. Northing and easting are in feet. Vertical control at each profile line consists of a third-order elevation of the top of the monument, with respect to the National Geodetic Vertical Datum of 1929. The horizontal and vertical control was done by Moorman and Little, Inc., 115 Broadfoot Avenue, Fayetteville, North Carolina.

All beach profile data were collected at these locations along a line through the monumented point in the direction given by the azimuth of the profile line. Measurements were taken by the firm of W. W. Blanchard, Inc., Wallace, North Carolina. The control surveys and beach profile line measurements were conducted under contracts to the U.S. Army Engineer District, Wilmington.

The black and white ground photos were taken at each profile line in June 1974 and are provided to illustrate the character of the beach at that time.

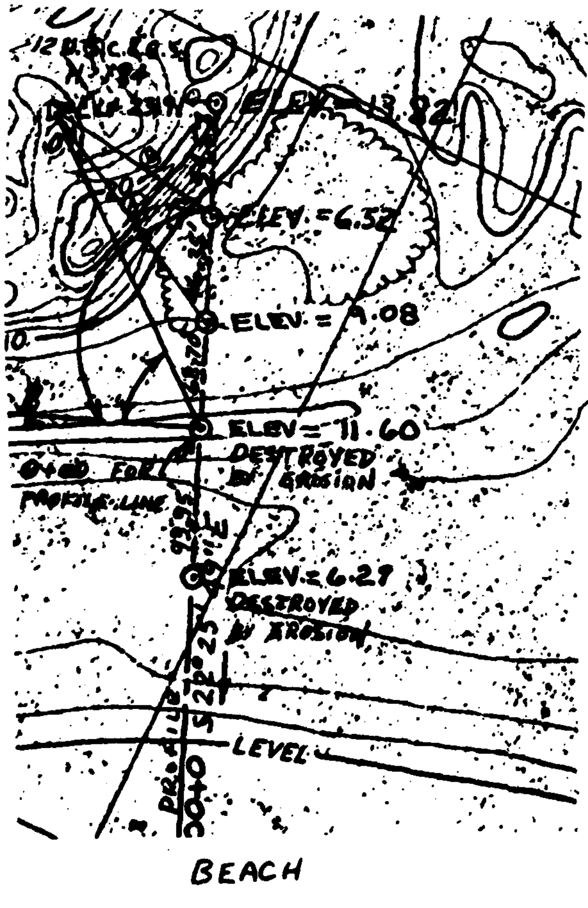
COUNTRY	TYPE OF MARK	STATION	
U.S.A.	GALV. PIPE	0+00.00 PROFILE 1	
LOCALITY	STAMPING ON MARK	AGENCY (CAST IN MARKS)	ELEVATION (FT)
HOLDEN BEACH, N.C.	0+00.00	C.E.	11.60 (DESTROYED)
LATITUDE	LONGITUDE	DATUM	DATUM
033-54-57.421	078-14-26.086	NORTH AMERICA 1927	1929 (M.S.L.)
(EASTING) (FT) (M)	(NORTHING) (FT) (M)	GRID AND ZONE	ESTABLISHED BY (AGENCY)
2230441.630	61281.010	N.C. LAMBERT	CERC
(NORTHING)(EASTING) (FT) (M)	(EASTING)(NORTHING) (FT) (M)	GRID AND ZONE	DATE / ORDER
			1970 / THIRD

TO OBTAIN GRID AZIMUTH, ADD ° ′ ″ TO THE GEODETIC AZIMUTH

TO OBTAIN GRID AZ. (ADD)(SUB.) ° ′ ″ TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID) (MAGNETIC)	BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
	° ′ ″	° ′ ″		

NOT SHOWN TO SCALE



U.S.C. & G.S. MONUMENT LOCATED AT HIGHEST POINT ON EAST END OF HOLDEN BEACH, GRASS DUNE WITH PATHS LEADING TO THE TOP.

DISTANCES
(A) 87.20′
(B) 78.86′
(C) 100.25′

0+00 FOR PROFILE LINE HAS BEEN DESTROYED BY EROSION, USE ONE OF 3 REMAINING PIPES AND PROPER DISTANCE TO LOCATE 0+00 FOR PROFILE LINE

BASELINE
STATION 0+00 IS LOCATED ABOUT 1600′ EAST OF THE EAST END OF PAVEMENT NEAR LOCKWOODS FOLLY INLET AT HOLDEN BEACH. IT HAS BEEN DESTROYED BY EROSION BUT POINT CAN BE RELOCATED FROM OFFSET PIPES

SKETCH

DA FORM 1 OCT 64 1959 REPLACES DA FORMS 1959 AND 1960, 1 FEB 57, WHICH ARE OBSOLETE.

DESCRIPTION OR RECOVERY OF HORIZONTAL CONTROL STATION
For use of this form, see TM 5-237; the proponent agency is U.S.Continental Army Command.

Profile line 1. View toward east over Lockwoods Folly Inlet.

Profile line 1. View toward west. Note vegetated dune and wide, unstructured beach.

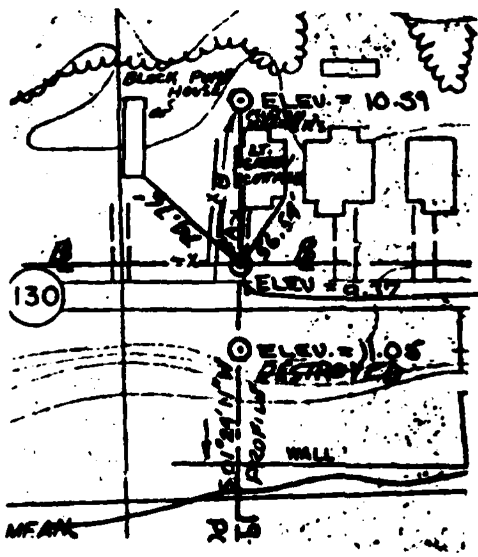
COUNTRY	TYPE OF MARK	STATION	
U.S.A.	GALV. PIPE	19+99.98 PROFILE 2	
LOCALITY: HOLDEN BEACH, N.C.	STAMPING ON MARK: 19+99.98	AGENCY (CAST IN MARKS): C.E.	ELEVATION (FT) (M): 9.37
LATITUDE: 33-54-51.361	LONGITUDE: 78-14-48.375	DATUM: NORTH AMERICA 1927	DATUM: 1929 (M.S.L.)
~~(NORTHING)~~(EASTING) (FT) (M): 2228567.700	~~(EASTING)~~(NORTHING) (FT) (M): 60654.010	GRID AND ZONE: N.C. LAMBERT	ESTABLISHED BY (AGENCY): CERC
(NORTHING)(EASTING) (FT) (M)	(EASTING)(NORTHING) (FT) (M)	GRID AND ZONE	DATE: 1970 / ORDER: THIRD

TO OBTAIN GRID AZIMUTH, ADD ° ′ ″ TO THE GEODETIC AZIMUTH

TO OBTAIN GRID AZ. (ADD)(SUB.) ° ′ ″ TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID) (MAGNETIC)	BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
	° ′ ″	° ′ ″		

NOT SHOWN TO SCALE



A = 48.42′
B = 104.19′

0+00 FOR PROFILE LINE IS MIDDLE PIPE

BEACH

BASELINE STATION 19+99.98 IS LOCATED ABOUT 330′ WEST OF EAST END OF PAVEMENT.

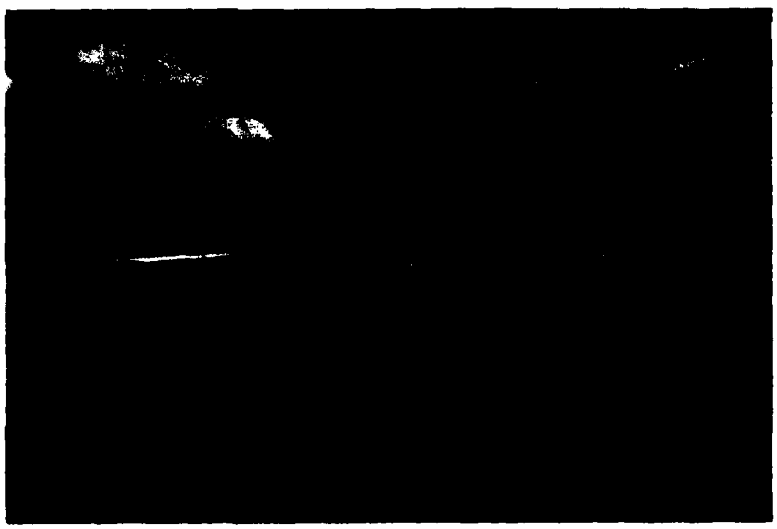
N

SKETCH

DA FORM 1 OCT 64 1959 REPLACES DA FORMS 1959 AND 1960, 1 FEB 57, WHICH ARE OBSOLETE.

DESCRIPTION OR RECOVERY OF HORIZONTAL CONTROL STATION
For use of this form, see TM 5-237; the proponent agency is U.S.Continental Army Command.

Profile line 2. View toward east



Profile line 2. View toward west. Note remains of timber pile bulkhead at right.

COUNTRY	TYPE OF MARK	STATION	
U.S.A.	GALV. PIPE	39+99.95 PROFILE 3	
LOCALITY	**STAMPING ON MARK**	**AGENCY (CAST IN MARKS)**	**ELEVATION (FT) (M)**
HOLDEN BEACH, N.C.	39+99.95	C.E.	8.71
LATITUDE	**LONGITUDE**	**DATUM**	**DATUM**
33-54-51.995	78-15-12.088	NORTH AMERICA 1927	1929 (M.S.L.)
~~(NORTHING)~~(EASTING) (FT) (M)	**~~(EASTING)~~(NORTHING) (FT) (M)**	**GRID AND ZONE**	**ESTABLISHED BY (AGENCY)**
2226568.330	60702.980	N.C. LAMBERT	CERC
(NORTHING)(EASTING) (FT) (M)	**(EASTING)(NORTHING) (FT) (M)**	**GRID AND ZONE**	**DATE / ORDER**
			1970 / THIRD

TO OBTAIN GRID AZIMUTH, ADD ° ′ ″ TO THE GEODETIC AZIMUTH

TO OBTAIN GRID AZ. (ADD)(SUB.) ° ′ ″ TO THE GEODETIC AZIMUTH

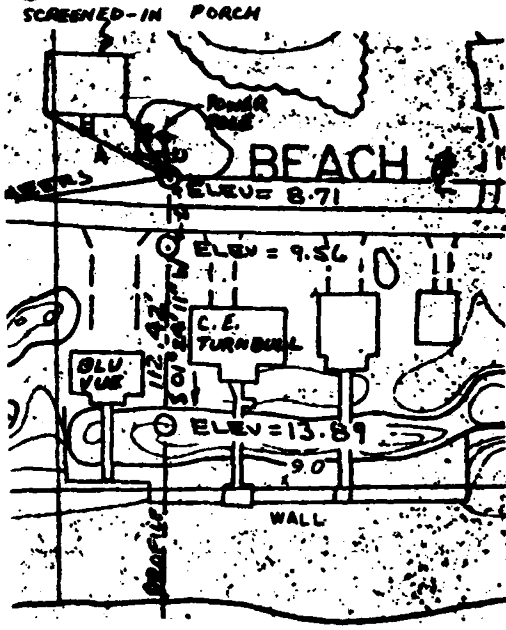
OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID) (MAGNETIC)	BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
	° ′ ″	° ′ ″		

NOT SHOWN TO SCALE

W. DAVID SMITH - 259 OCEAN-AIRE APTS.

BROWN COTTAGE WITH

SCREENED-IN PORCH



A = 83.89′
B = 48.53′
C = 25.05′
D = 46.02′

STATION NO. PAINTED IN NORTH LANE.

0+00 ON PROFILE LINE IS NORTH-MOST PIPE

BEACH

BASELINE STATION 39+99.95 IS LOCATED 2300′ WEST OF THE EAST END OF PAVEMENT AT HOLDEN BEACH.

N

SKETCH

DA FORM 1 OCT 64 1959 REPLACES DA FORMS 1959 AND 1960, 1 FEB 57, WHICH ARE OBSOLETE. **DESCRIPTION OR RECOVERY OF HORIZONTAL CONTROL STATION** For use of this form, see TM 5-237; the proponent agency is U.S.Continental Army Command.

Profile line 3. View toward east.

Profile line 3. View toward west. Note timber pile bulkhead in each picture.

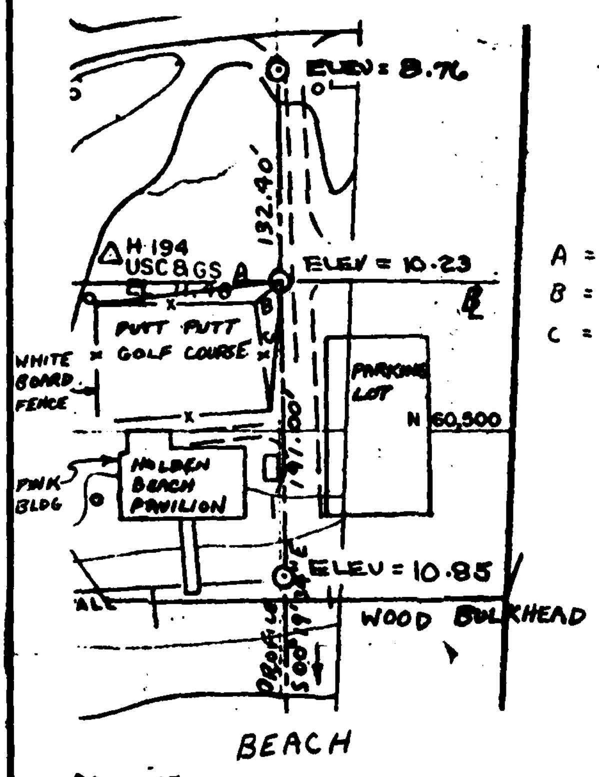
COUNTRY	TYPE OF MARK	STATION	
U.S.A.	GALV. PIPE	60+75.13 PROFILE 4	
LOCALITY	STAMPING ON MARK	AGENCY (CAST IN MARKS)	ELEVATION (FT) (M)
HOLDEN BEACH, N.C.	60+75.13	C.E.	10.23
LATITUDE	LONGITUDE	DATUM	DATUM
33-54-51.131	78-15-36.630	NORTH AMERICA 1927	1929 (M.S.L.)
~~(NORTHING)~~(EASTING) (FT) (M)	~~(EASTING)~~(NORTHING) (FT) (M)	GRID AND ZONE	ESTABLISHED BY (AGENCY)
2224500.290	60600.230	N.C. LAMBERT	CERC
(NORTHING)(EASTING) (FT) (M)	(EASTING)(NORTHING) (FT) (M)	GRID AND ZONE	DATE / ORDER
			1970 / THIRD

TO OBTAIN GRID AZIMUTH, ADD ° ' " TO THE GEODETIC AZIMUTH

TO OBTAIN GRID AZ. (ADD)(SUB.) ° ' " TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID)(MAGNETIC)	BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
	° ' "	° ' "		

NOT SHOWN TO SCALE



← PIPE MISSING (OCT 75) OR BURIED

A = 114.98'
B = 19.14'
C = 85.22'

0+00 ON PROFILE LINE IS MIDDLE PIPE (MISSING IN JUNE 1974)

BASELINE STATION 60+75.13 IS LOCATED JUST EAST OF THE SURFSIDE PAVILION.

N

SKETCH

DA FORM 1 OCT 64 1959 REPLACES DA FORMS 1959 AND 1960, 1 FEB 57, WHICH ARE OBSOLETE.

DESCRIPTION OR RECOVERY OF HORIZONTAL CONTROL STATION
For use of this form, see TM 5-237; the proponent agency is U.S.Continental Army Command.

Profile line 4. View toward east.

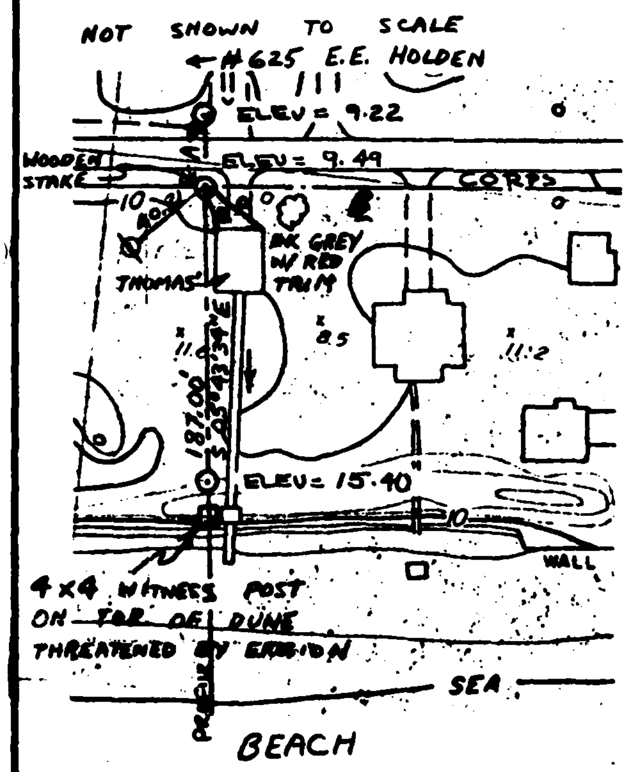
Profile line 4. View toward west from edge of back filled timber pile bulkhead.

COUNTRY	TYPE OF MARK	STATION	
U.S.A.	GALV. PIPE	80+13.75 PROFILE 5	
LOCALITY: HOLDEN BEACH, N.C.	STAMPING ON MARK: 80+ 13.75	AGENCY (CAST IN MARKS): C.E.	ELEVATION (FT) (M): 9.49
LATITUDE: 33-54-50.168	LONGITUDE: 78-15-59.576	DATUM: NORTH AMERICA 1927	DATUM: 1929 (M.S.L.)
~~(NORTHING)~~(EASTING) (FT) (M): 2222567.020	~~(EASTING)~~(NORTHING) (FT) (M): 60488.610	GRID AND ZONE: N.C. LAMBERT	ESTABLISHED BY (AGENCY): CERC
(NORTHING)(EASTING) (FT) (M)	(EASTING)(NORTHING) (FT) (M)	GRID AND ZONE	DATE: 1970 ORDER: THIRD

TO OBTAIN GRID AZIMUTH, ADD ° ′ ″ TO THE GEODETIC AZIMUTH

TO OBTAIN GRID AZ. (ADD)(SUB.) ° ′ ″ TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID) (MAGNETIC) ° ′ ″	BACK AZIMUTH ° ′ ″	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)



A = 44.65'
B = 26.92
C = 38.85'

0+00 ON PROFILE LINE IS MIDDLE PIPE

BURIED (OCT 75)

BASELINE STATION 80+ 13.75 IS LOCATED ABOUT 250' EAST OF THE INTERSECTION OF THE ROAD THAT CONNECTS THE ISLAND WITH THE MAINLAND AND WEST OCEAN DRIVE.

SKETCH

DA FORM 1959 1 OCT 64 REPLACES DA FORMS 1959 AND 1960, 1 FEB 57, WHICH ARE OBSOLETE.

DESCRIPTION OR RECOVERY OF HORIZONTAL CONTROL STATION
For use of this form, see TM 5-237; the proponent agency is U.S.Continental Army Command.

Profile line 5. View toward east.

Profile line 5. View toward west.

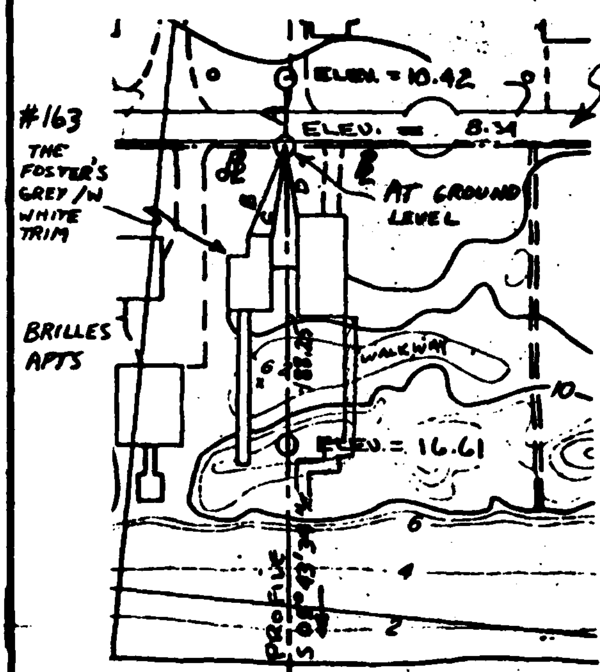
COUNTRY	TYPE OF MARK	STATION	
U.S.A.	GALV. PIPE	100+15.32 PROFILE 6	
LOCALITY	STAMPING ON MARK	AGENCY (CAST IN MARKS)	ELEVATION (FT) (M)
HOLDEN BEACH, N.C.	100+15.32	C.E.	8.34
LATITUDE	LONGITUDE	DATUM	DATUM
33-54-48.338	78-16-23.219	NORTH AMERICA 1927	1929 (M.S.L.)
~~(NORTHING)~~(EASTING) (FT) (M)	~~(EASTING)~~(NORTHING) (FT) (M)	GRID AND ZONE	ESTABLISHED BY (AGENCY)
2220575.440	60288.910	N.C. LAMBERT	CERC
(NORTHING)(EASTING) (FT) (M)	(EASTING)(NORTHING) (FT) (M)	GRID AND ZONE	DATE / ORDER
			1970 / THIRD

TO OBTAIN GRID AZIMUTH, ADD ° ' " TO THE GEODETIC AZIMUTH

TO OBTAIN GRID AZ. (ADD)(SUB.) ° ' " TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID)(MAGNETIC)	BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
	° ' "	° ' "		

NOT SHOWN TO SCALE



STATION NO. PAINTED ON ROAD

A = 41.75'

B = 60.35'

C = 56.12'

D = 42.96'

0+00 ON PROFILE-LINE IS MIDDLE PIPE (BURIED)

BEACH

BASELINE STATION 100+15.32 IS LOCATED 1750' WEST OF THE INTERSECTION OF WEST OCEAN DRIVE AND THE ROAD TO THE MAINLAND, NEAR BRILLE'S APARTMENTS.

N

SKETCH

DA FORM 1 OCT 64 1959 REPLACES DA FORMS 1959 AND 1960, 1 FEB 57, WHICH ARE OBSOLETE.

DESCRIPTION OR RECOVERY OF HORIZONTAL CONTROL STATION
For use of this form, see TM 5-237; the proponent agency is U.S.Continental Army Command.

Profile line 6. View toward east.

Profile line 6. View toward west. Note houses in the vegetated dune and beach access points.

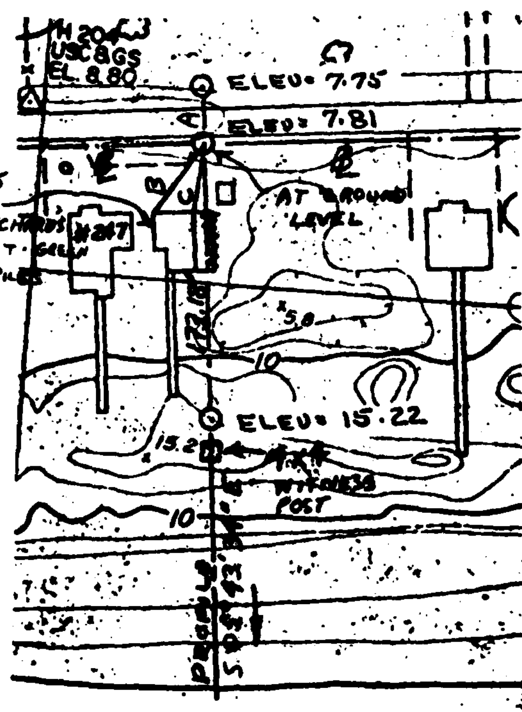
COUNTRY	TYPE OF MARK	STATION	
U.S.A.	GALV. PIPE	120+00.07 PROFILE 7	
LOCALITY	STAMPING ON MARK	AGENCY (CAST IN MARKS)	ELEVATION (FT) (M)
HOLDEN BEACH, N.C.	120+00.07	C.E.	7.81
LATITUDE	LONGITUDE	DATUM	DATUM
33-54-46.523	78-16-46.664	NORTH AMERICA 1927	1929 (M.S.L.)
~~(NORTHING)~~(EASTING) (FT) (M)	~~(EASTING)~~(NORTHING) (FT) (M)	GRID AND ZONE	ESTABLISHED BY (AGENCY)
2218600.590	60090.880	N.C. LAMBERT	CERC
(NORTHING)(EASTING) (FT) (M)	(EASTING)(NORTHING) (FT) (M)	GRID AND ZONE	DATE: 1970 / ORDER: THIRD

TO OBTAIN GRID AZIMUTH, ADD ° ' " TO THE GEODETIC AZIMUTH

TO OBTAIN GRID AZ. (ADD)(SUB.) ° ' " TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID) (MAGNETIC)	BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
	° ' "	° ' "		

NOT SHOWN TO SCALE



STATION NO. PAINTED ON ROAD

A = 37.00'
B = 57.16'
C = 43.57'

0+00 ON PROFILE LINE IS MIDDLE PIPE

BASELINE
STATION 120+00.07 IS LOCATED ABOUT 3700' WEST OF THE INTERSECTION OF THE MAINLAND AND WEST OCEAN DRIVE.

N

SKETCH

DA FORM 1 OCT 64 1959 REPLACES DA FORMS 1959 AND 1960, 1 FEB 57, WHICH ARE OBSOLETE.

DESCRIPTION OR RECOVERY OF HORIZONTAL CONTROL STATION
For use of this form, see TM 5-237; the proponent agency is U.S.Continental Army Command.

Profile line 7. View toward east.

Profile line 7. View toward west.

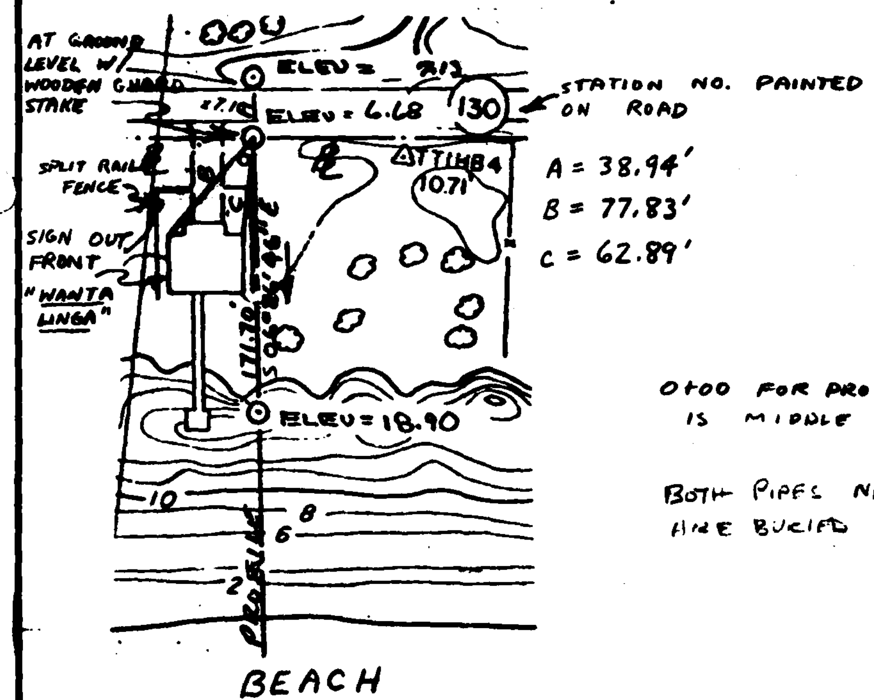
COUNTRY	TYPE OF MARK	STATION	
U.S.A.	GALV. PIPE	140+61.79 PROFILE 8	
LOCALITY	STAMPING ON MARK	AGENCY (CAST IN MARKS)	ELEVATION (FT) (M)
HOLDEN BEACH, N.C.	140+61.79	C.E.	6.68
LATITUDE	LONGITUDE	DATUM	DATUM
33-54-44.417	78-17-10.991	NORTH AMERICA 1927	1929 (M.S.L.)
~~(NORTHING)~~(EASTING) (FT) (M)	~~(EASTING)~~(NORTHING) (FT) (M)	GRID AND ZONE	ESTABLISHED BY (AGENCY)
2216551.500	59863.170	N.C. LAMBERT	CERC
(NORTHING)(EASTING) (FT) (M)	(EASTING)(NORTHING) (FT) (M)	GRID AND ZONE	DATE / ORDER
			1970 / THIRD

TO OBTAIN GRID AZIMUTH, ADD ° ' " TO THE GEODETIC AZIMUTH

TO OBTAIN GRID AZ. (ADD)(SUB.) ° ' " TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID) (MAGNETIC)	BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
	° ' "	° ' "		

NOT SHOWN TO SCALE



A = 38.94'
B = 77.83'
C = 62.89'

0+00 FOR PROFILE LINE IS MIDDLE PIPE

BOTH PIPES NEAR ROAD ARE BURIED

BASELINE STATION 140+61.79 IS LOCATED ABOUT 1 MILE WEST OF THE INTERSECTION OF THE MAINLAND ROAD AND WEST OCEAN DRIVE.

N

SKETCH

DA FORM 1959 1 OCT 64 REPLACES DA FORMS 1959 AND 1960, 1 FEB 57, WHICH ARE OBSOLETE. DESCRIPTION OR RECOVERY OF HORIZONTAL CONTROL STATION

For use of this form, see TM 5-237; the proponent agency is U.S.Continental Army Command.

Profile line 8. View toward east.

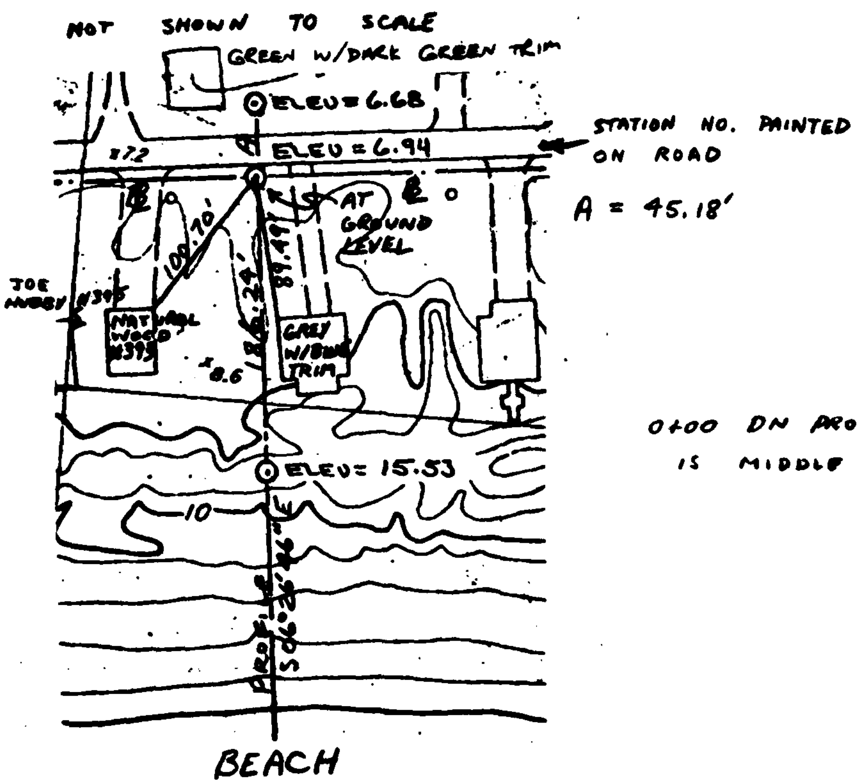
Profile line 8. View toward west.

COUNTRY	TYPE OF MARK	STATION	
U.S.A.	GALV. PIPE	160+15.75 PROFILE 9	
LOCALITY: HOLDEN BEACH, N.C.	STAMPING ON MARK: 160+15.75	AGENCY (CAST IN MARKS): C.E.	ELEVATION (FT) (M): 6.94
LATITUDE: 33-54-42.384	LONGITUDE: 78-17-34.043	DATUM: NORTH AMERICA 1927	DATUM: 1929 (M.S.L.)
~~(NORTHING)~~(EASTING) (FT) (M): 2214609.900	~~(EASTING)~~(NORTHING) (FT) (M): 59643.800	GRID AND ZONE: N.C. LAMBERT	ESTABLISHED BY (AGENCY): CERC
(NORTHING)(EASTING) (FT) (M)	(EASTING)(NORTHING) (FT) (M)	GRID AND ZONE	DATE: 1970 / ORDER: THIRD

TO OBTAIN GRID AZIMUTH, ADD ° ' " TO THE GEODETIC AZIMUTH

TO OBTAIN GRID AZ. (ADD)(SUB.) ° ' " TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID) (MAGNETIC)	BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
	° ' "	° ' "		



BASELINE STATION 160+15.75 IS LOCATED ABOUT 1.5 MILES WEST OF THE INTERSECTION OF THE MAINLAND ROAD AND WEST OCEAN DRIVE.

N

SKETCH

DA FORM 1959, 1 OCT 58 — REPLACES DA FORMS 1959 AND 1960, 1 FEB 57, WHICH ARE OBSOLETE.

DESCRIPTION OR RECOVERY OF HORIZONTAL CONTROL STATION
For use of this form, see TM 5-237; the proponent agency is U.S.Continental Army Command.

Profile line 9. View toward east.

Profile line 9. View toward west.

COUNTRY	TYPE OF MARK	STATION	
U.S.A.	GALV. PIPE	180+00.32 PROFILE 10	
LOCALITY	STAMPING ON MARK	AGENCY (CAST IN MARKS)	ELEVATION (FT) (M)
HOLDEN BEACH, N.C.	180+00.32	C.E.	7.14
LATITUDE	LONGITUDE	DATUM	DATUM
33-54-40.486	78-17-57.476	NORTH AMERICA 1927	1929 (M.S.L.)
~~(NORTHING)~~(EASTING) (FT) (M)	~~(EASTING)~~(NORTHING) (FT) (M)	GRID AND ZONE	ESTABLISHED BY (AGENCY)
2212636.030	59437.980	N.C. LAMBERT	CERC
(NORTHING)(EASTING) (FT) (M)	(EASTING)(NORTHING) (FT) (M)	GRID AND ZONE	DATE / ORDER
			1970 / THIRD

TO OBTAIN GRID AZIMUTH, ADD ° ' " TO THE GEODETIC AZIMUTH

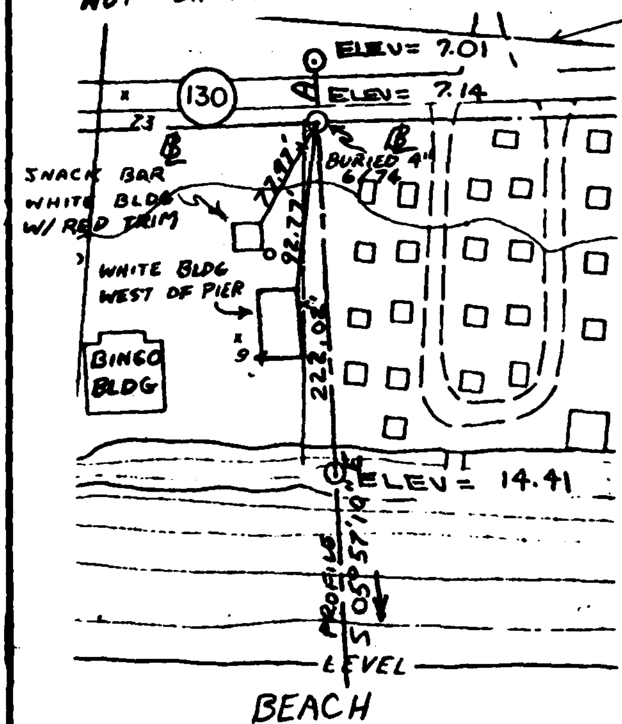
TO OBTAIN GRID AZ. (ADD)(SUB.) ° ' " TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID)(MAGNETIC)	BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
	° ' "	° ' "		

NOT SHOWN TO SCALE

PIPE BENT OVER 49.4' FROM POWER POLE, 4' FROM TIP OF ORANGE ARROW IN ROAD (OCT 75)

A = 38.87'



0+00 ON PROFILE LINE IS MIDDLE PIPE

BEACH

BASELINE STATION 180+00.32 IS LOCATED ABOUT 500' WEST OF THE HOLDEN BEACH FISHING PIER.

N

SKETCH

DA FORM 1 OCT 64 1959 REPLACES DA FORMS 1959 AND 1960, 1 FEB 57, WHICH ARE OBSOLETE.

DESCRIPTION OR RECOVERY OF HORIZONTAL CONTROL STATION
For use of this form, see TM 5-237; the proponent agency is U.S.Continental Army Command.

Profile line 10. View toward west.

Profile line 10. View toward east and Holden Beach fishing pier.

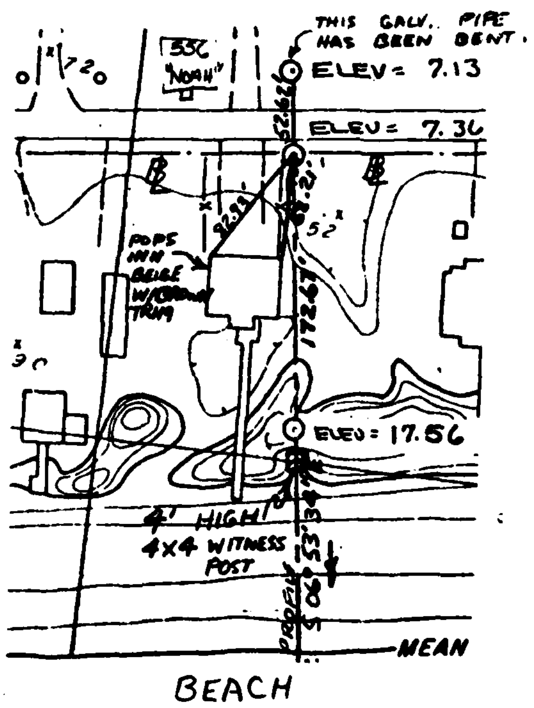
COUNTRY	TYPE OF MARK	STATION	
U.S.A.	GALV. PIPE	200 + 51.65 PROFILE 11	
LOCALITY HOLDEN BEACH , U.S.	STAMPING ON MARK 200 + 51.65	AGENCY (CAST IN MARKS) C.E.	ELEVATION (FT) (M) 7.36
LATITUDE 33-54-38.250	LONGITUDE 78-18-21.609	DATUM NORTH AMERICA 1927	DATUM 1929 (M.S.L.)
~~(NORTHING)~~(EASTING) (FT) (M) 2210603.310	~~(EASTING)~~(NORTHING) (FT) (M) 59197.580	GRID AND ZONE N.C. LAMBERT	ESTABLISHED BY (AGENCY) CERC
(NORTHING)(EASTING) (FT) (M)	(EASTING)(NORTHING) (FT) (M)	GRID AND ZONE	DATE 1970 ORDER THIRD

TO OBTAIN GRID AZIMUTH, ADD ° ′ ″ TO THE GEODETIC AZIMUTH

TO OBTAIN GRID AZ. (ADD)(SUB.) ° ′ ″ TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID) (MAGNETIC) ° ′ ″	BACK AZIMUTH ° ′ ″	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)

NOT SHOWN TO SCALE



0+00 ON PROFILE LINE IS MIDDLE PIPE

BASELINE STATION 200+51.65 IS LOCATED ABOUT 0.5 MILE WEST OF THE HOLDEN BEACH FISHISG PIER.

N

SKETCH

DA FORM 1959 1 OCT 64 REPLACES DA FORMS 1959 AND 1960, 1 FEB 57, WHICH ARE OBSOLETE.

DESCRIPTION OR RECOVERY OF HORIZONTAL CONTROL STATION

For use of this form, see TM 5-237; the proponent agency is U.S.Continental Army Command.

Profile line 11. View toward east.

Profile line 11. View toward west.

COUNTRY	TYPE OF MARK	STATION	
U.S.A.	GALV. MARK	220+00.74 PROFILE 12	
LOCALITY: HOLDEN BEACH, N.C.	STAMPING ON MARK: 220+00.74	AGENCY (CAST IN MARKS): C.E.	ELEVATION (FT) (M): 8.96
LATITUDE: 33-54-36.070	LONGITUDE: 78-18-44.583	DATUM: NORTH AMERICA 1927	DATUM: 1929 (M.S.L.)
~~(NORTHING)~~(EASTING) (FT) (M): 2208668.310	~~(EASTING)~~(NORTHING) (FT) (M): 58963.670	GRID AND ZONE: N.C. LAMBERT	ESTABLISHED BY (AGENCY): CERC
(NORTHING)(EASTING) (FT) (M)	(EASTING)(NORTHING) (FT) (M)	GRID AND ZONE	DATE: 1970 / ORDER: THIRD

TO OBTAIN GRID AZIMUTH, ADD ° ' " TO THE GEODETIC AZIMUTH

TO OBTAIN GRID AZ. (ADD)(SUB.) ° ' " TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID)(MAGNETIC) ° ' "	BACK AZIMUTH ° ' "	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)

NOT SHOWN TO SCALE

STATION NO. PAINTED ON ROAD

A = 39.50'
B = 71.55'
C = 29.97'
D = 58.28'

0+00 ON PROFILE LINE IS MIDDLE PIPE

COULD NOT LOCATE DUNE PIPE (OCT 8)

BASELINE STATION 220+00.74 IS LOCATED ABOUT 4500' WEST OF THE HOLDEN BEACH FISHING PIER.

N

SKETCH

DA FORM 1 OCT 64 1959 REPLACES DA FORMS 1959 AND 1960, 1 FEB 57, WHICH ARE OBSOLETE.

DESCRIPTION OR RECOVERY OF HORIZONTAL CONTROL STATION
For use of this form, see TM 5-237; the proponent agency is U.S. Continental Army Command.

Profile line 12. View toward east.

Profile line 12. View toward west.

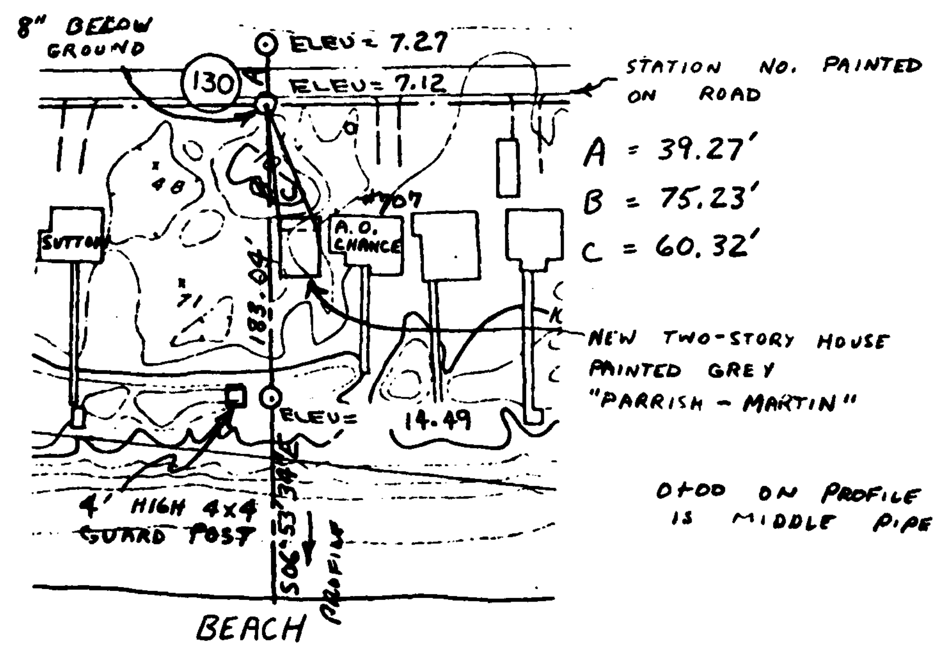
COUNTRY	TYPE OF MARK	STATION	
U. S. A.	GALV. PIPE	240+08.64	PROFILE 13
LOCALITY	STAMPING ON MARK	AGENCY (CAST IN MARKS)	ELEVATION (FT) (M)
HOLDEN BEACH, N.C.	240+08.64	C.E.	7.12
LATITUDE	LONGITUDE	DATUM	DATUM
33-54-33.823	78-19-08.250	NORTH AMERICA 1927	1929 (M.S.L.)
~~(NORTHING)~~(EASTING) (FT) (M)	~~(EASTING)~~(NORTHING) (FT) (M)	GRID AND ZONE	ESTABLISHED BY (AGENCY)
2206674.920	58722.700	N.C. LAMBERT	CERC
(NORTHING)(EASTING) (FT) (M)	(EASTING)(NORTHING) (FT) (M)	GRID AND ZONE	DATE / ORDER
			1970 / THIRD

TO OBTAIN GRID AZIMUTH, ADD ° ' " TO THE GEODETIC AZIMUTH

TO OBTAIN GRID AZ. (ADD)(SUB.) ° ' " TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID)(MAGNETIC) ° ' "	BACK AZIMUTH ° ' "	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)

NOT SHOWN TO SCALE



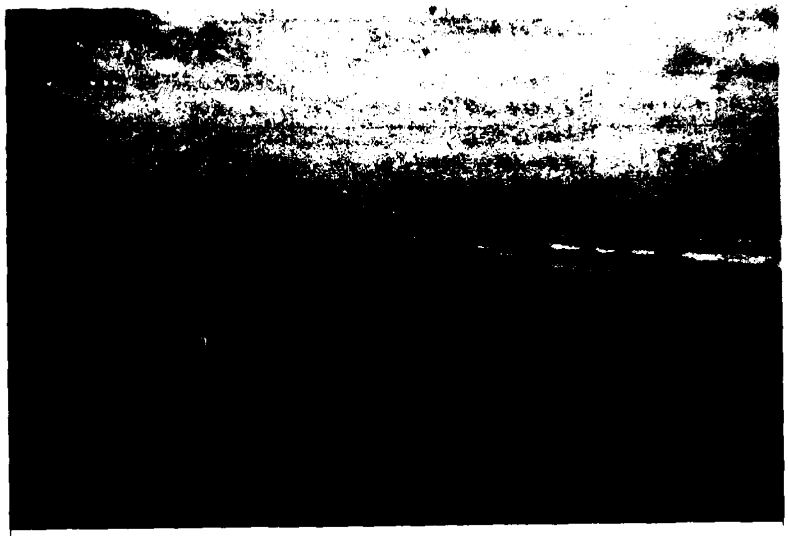
BASELINE STATION 240+08.64 IS LOCATED ABOUT 1.25 MILES WEST OF THE HOLDEN BEACH FISHING PIER.

N

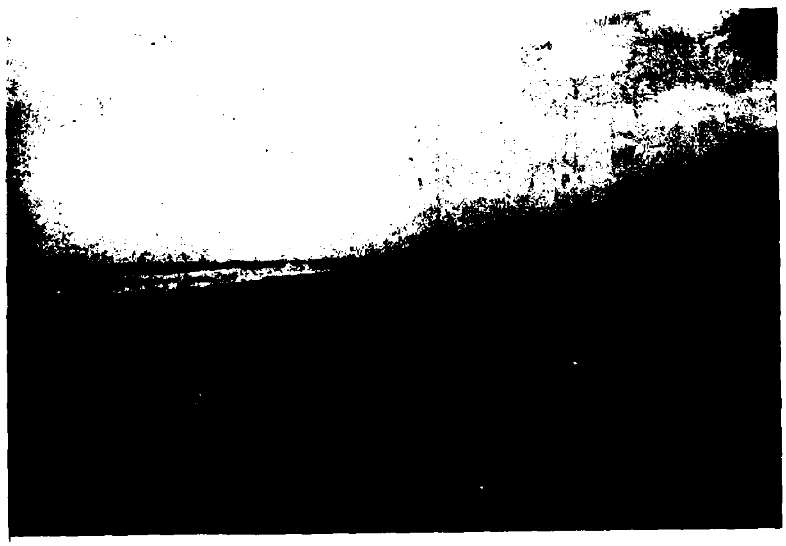
SKETCH

DA FORM 1 OCT 64 1959 REPLACES DA FORMS 1959 AND 1960, 1 FEB 57, WHICH ARE OBSOLETE.

DESCRIPTION OR RECOVERY OF HORIZONTAL CONTROL STATION
For use of this form, see TM 5-237; the proponent agency is U.S.Continental Army Command.



Profile line 13. View toward east.



Profile line 13. View toward west.

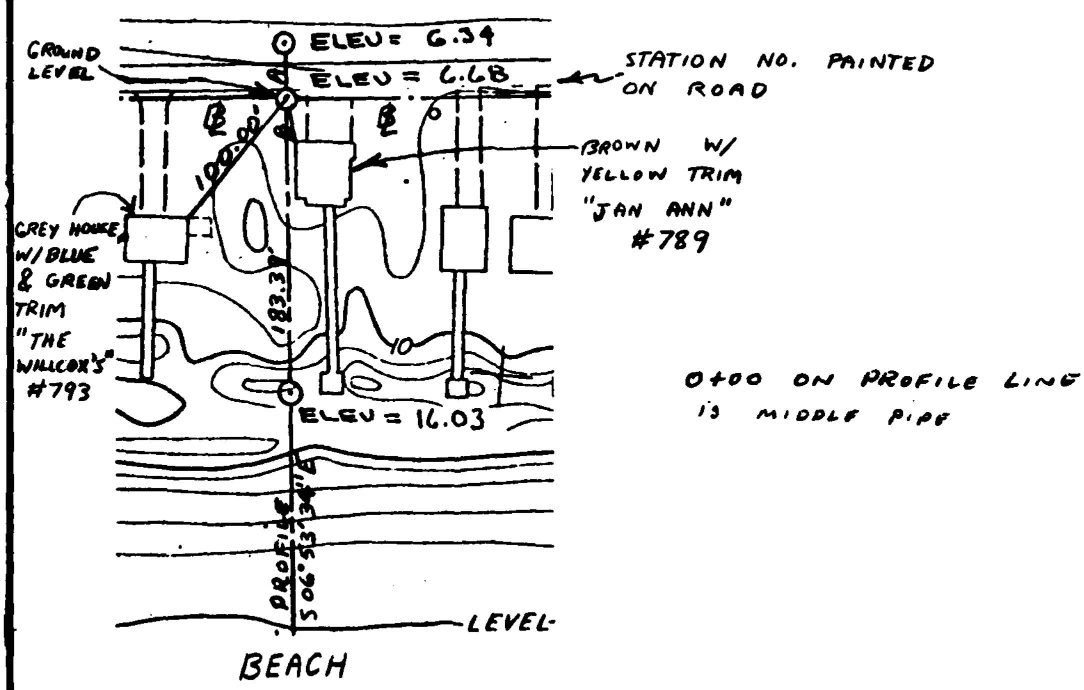
COUNTRY	TYPE OF MARK	STATION	
U.S.A.	GALV. PIPE	260+04.84 PROFILE 14	
LOCALITY	STAMPING ON MARK	AGENCY (CAST IN MARKS)	ELEVATION (FT) (M)
HOLDEN BEACH, N.C.	260+04.84	C.E.	6.68
LATITUDE	LONGITUDE	DATUM	DATUM
33-54-31.587	78-19-31.776	NORTH AMERICA 1927	1929 (M.S.L.)
~~(NORTHING)~~(EASTING) (FT) (M)	~~(EASTING)~~(NORTHING) (FT) (M)	GRID AND ZONE	ESTABLISHED BY (AGENCY)
2204693.150	58483.130	N.C. LAMBERT	CERC
(NORTHING)(EASTING) (FT) (M)	(EASTING)(NORTHING) (FT) (M)	GRID AND ZONE	DATE / ORDER
			1970 / THIRD

TO OBTAIN GRID AZIMUTH, ADD ° ′ ″ TO THE GEODETIC AZIMUTH

TO OBTAIN GRID AZ. (ADD)(SUB.) ° ′ ″ TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID)(MAGNETIC)	BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
	° ′ ″	° ′ ″		

NOT SHOWN TO SCALE



BASELINE STATION 260+04.84 IS LOCATED ABOUT 1.5 MILES WEST OF HOLDEN BEACH FISHING PIER.

N

SKETCH

DA FORM 1 OCT 64 1959 REPLACES DA FORMS 1959 AND 1960, 1 FEB 57, WHICH ARE OBSOLETE.

DESCRIPTION OR RECOVERY OF HORIZONTAL CONTROL STATION
For use of this form, see TM 5-237; the proponent agency is U.S.Continental Army Command.

Profile line 14. View toward east.

Profile line 14. View toward west.

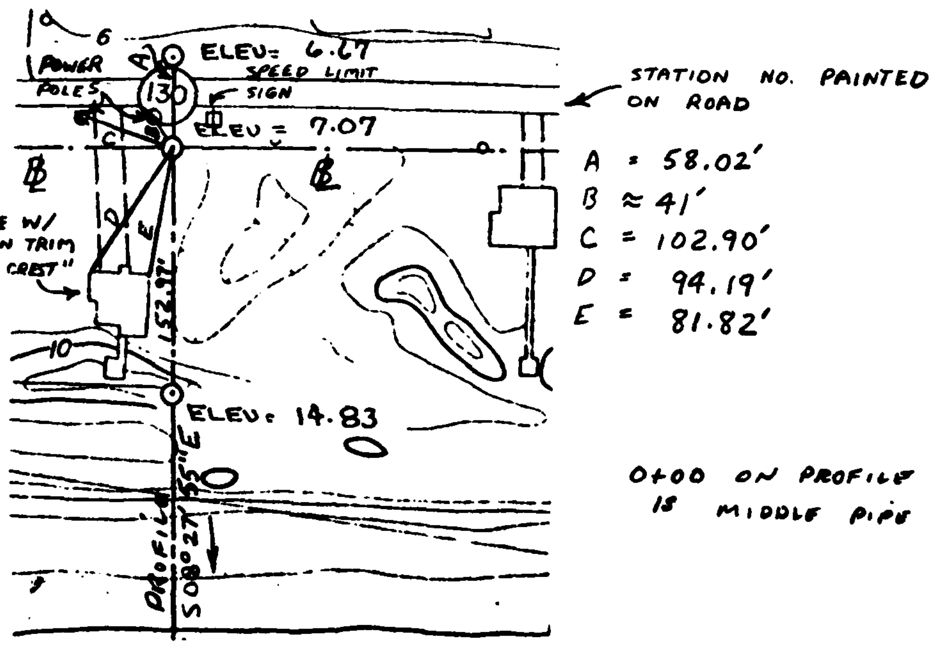
COUNTRY	TYPE OF MARK	STATION	
U. S. A.	GALV. PIPE	279+90.14	PROFILE 15
LOCALITY	**STAMPING ON MARK**	**AGENCY (CAST IN MARKS)**	**ELEVATION** (FT) (M)
HOLDEN BEACH, N.C.	279+90.14	C. E.	7.07
LATITUDE	**LONGITUDE**	**DATUM**	**DATUM**
33-54-29.095	78-19-55.135	NORTH AMERICA 1927	1929 (M.S.L.)
~~(NORTHING)~~(EASTING) (FT) (M)	**~~(EASTING)~~(NORTHING)** (FT) (M)	**GRID AND ZONE**	**ESTABLISHED BY (AGENCY)**
2202725.820	58217.970	N.C. LAMBERT	CERC
(NORTHING)(EASTING) (FT) (M)	**(EASTING)(NORTHING)** (FT) (M)	**GRID AND ZONE**	**DATE** 1970 / **ORDER** THIRD

TO OBTAIN GRID AZIMUTH, ADD ° ′ ″ TO THE GEODETIC AZIMUTH

TO OBTAIN GRID AZ. (ADD)(SUB.) ° ′ ″ TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID) (MAGNETIC) ° ′ ″	BACK AZIMUTH ° ′ ″	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)

NOT SHOWN TO SCALE



BEACH

0+00 ON PROFILE LINE IS MIDDLE PIPE

BASELINE STATION 279+90.14 IS LOCATED ABOUT 2.0 MILES WEST OF THE HOLDEN BEACH FISHING PIER.

N

SKETCH

DA FORM 1 OCT 64 **1959** REPLACES DA FORMS 1959 AND 1960, 1 FEB 57, WHICH ARE OBSOLETE.

DESCRIPTION OR RECOVERY OF HORIZONTAL CONTROL STATION
For use of this form, see TM 5-237; the proponent agency is U.S. Continental Army Command.

Profile line 15. View toward east.

Profile line 15. View toward west. Note wave cut scarp in toe of dune.

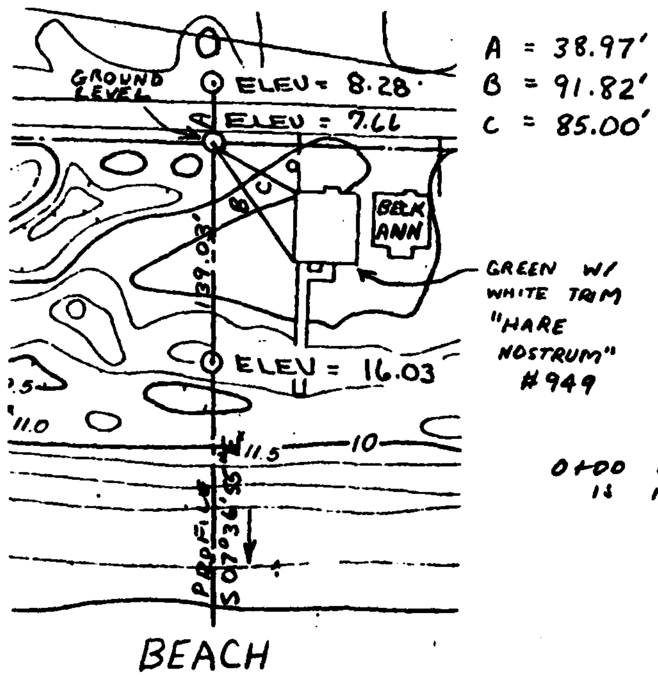
COUNTRY	TYPE OF MARK	STATION	
U.S.A.	GALV. PIPE	300+01.44 PROFILE 16	
LOCALITY	STAMPING ON MARK	AGENCY (CAST IN MARKS)	ELEVATION (FT) (M)
HOLDEN BEACH, N.C.	300+01.44	C.E.	7.66
LATITUDE	LONGITUDE	DATUM	DATUM
33-54-26.444	78-20-18-781	NORTH AMERICA 1927	1929 (M.S.L.)
~~(NORTHING)~~(EASTING) (FT) (M)	~~(EASTING)~~(NORTHING) (FT) (M)	GRID AND ZONE	ESTABLISHED BY (AGENCY)
2200734.360	57936.580	N.C. LAMBERT	CERC
(NORTHING)(EASTING) (FT) (M)	(EASTING)(NORTHING) (FT) (M)	GRID AND ZONE	DATE / ORDER
			1970 / THIRD

TO OBTAIN GRID AZIMUTH, ADD ° ' " TO THE GEODETIC AZIMUTH

TO OBTAIN GRID AZ. (ADD)(SUB.) ° ' " TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID)(MAGNETIC)	BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
	° ' "	° ' "		

NOT SHOWN TO SCALE



0+00 ON PROFILE LINE IS MIDDLE PIPE

BASELINE STATION 300+01.44 IS LOCATED ABOUT 2.5 MILES WEST OF THE HOLDEN BEACH FISHING PIER.

N

SKETCH

DA FORM 1 OCT 64 1959 REPLACES DA FORMS 1958 AND 1960, 1 FEB 57, WHICH ARE OBSOLETE.

DESCRIPTION OR RECOVERY OF HORIZONTAL CONTROL STATION
For use of this form, see TM 5-237; the proponent agency is U.S.Continental Army Command.

Profile line 16. View toward east.

Profile line 16. View toward west.

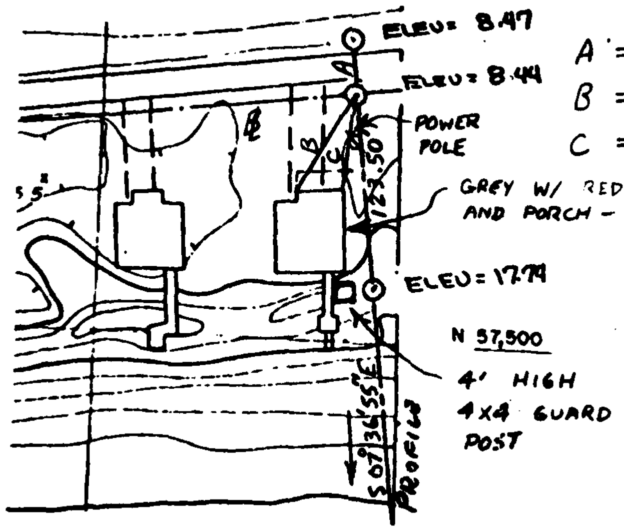
COUNTRY	TYPE OF MARK	STATION	
U.S.A.	GALV. PIPE	320+ 95.11 PROFILE 17	
LOCALITY	STAMPING ON MARK	AGENCY (CAST IN MARKS)	ELEVATION (FT)(M)
HOLDEN BEACH, N.C.	320+ 95.11	C. E.	8.44 (CAP BROKEN)
LATITUDE	LONGITUDE	DATUM	DATUM
33-54-23.836	78-20-43.420	NORTH AMERICA 1927	1929 (M.S.L.)
~~(NORTHING)~~(EASTING) (FT)(M)	~~(EASTING)~~(NORTHING) (FT)(M)	GRID AND ZONE	ESTABLISHED BY (AGENCY)
2198659.160	57659.120	N.C. LAMBERT	CERC
(NORTHING)(EASTING) (FT)(M)	(EASTING)(NORTHING) (FT)(M)	GRID AND ZONE	DATE / ORDER
			1970 / THIRD

TO OBTAIN GRID AZIMUTH, ADD ° ′ ″ TO THE GEODETIC AZIMUTH

TO OBTAIN GRID AZ. (ADD)(SUB.) ° ′ ″ TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID)(MAGNETIC) ° ′ ″	BACK AZIMUTH ° ′ ″	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)

NOT SHOWN TO SCALE



A = 34.35′
B = 89.62′
C = 75.31′

0+00 ON PROFILE LINE IS MIDDLE PIPE

BEACH

BASELINE STATION 320 + 95.11 IS LOCATED ABOUT 2.9 MILES WEST OF THE HOLDEN BEACH FISHING PIER.

N

SKETCH

DA FORM 1959, 1 OCT 64 — REPLACES DA FORMS 1959 AND 1960, 1 FEB 57, WHICH ARE OBSOLETE.

DESCRIPTION OR RECOVERY OF HORIZONTAL CONTROL STATION
For use of this form, see TM 5-237; the proponent agency is U.S.Continental Army Command.

Profile line 17. View toward east.

Profile line 17. View toward west.

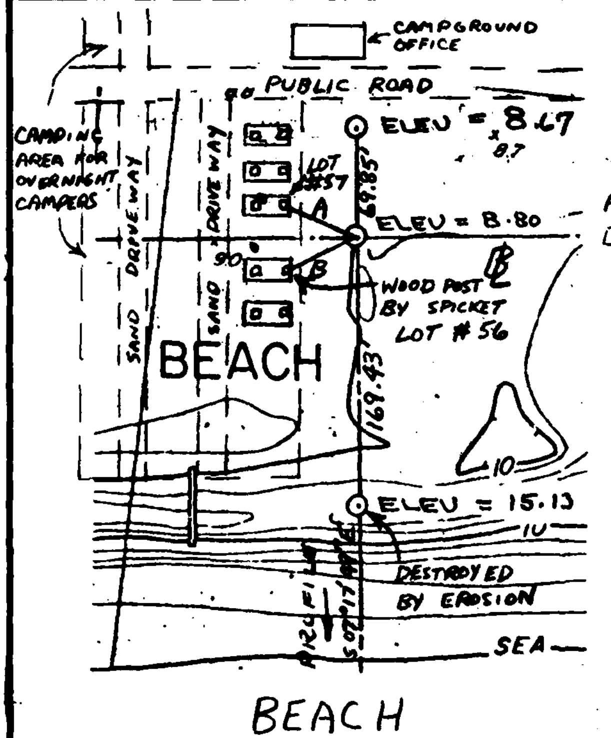
COUNTRY U.S.A.	TYPE OF MARK GALV. PIPE	STATION 341+47.07	PROFILE 18
LOCALITY HOLDEN BEACH, N.C.	STAMPING ON MARK 341+47.07	AGENCY (CAST IN MARKS) C.E.	ELEVATION (FT) (M) 8.80
LATITUDE 33-54-21.390	LONGITUDE 78-21-07.582	DATUM NORTH AMERICA 1927	DATUM 1929 (M.S.L.)
~~(NORTHING)~~(EASTING) (FT) (M) 2196623.820	~~(EASTING)~~(NORTHING) (FT) (M) 57398.500	GRID AND ZONE N.C. LAMBERT	ESTABLISHED BY (AGENCY) CERC
(NORTHING)(EASTING) (FT) (M)	(EASTING)(NORTHING) (FT) (M)	GRID AND ZONE	DATE 1970 / ORDER THIRD

TO OBTAIN GRID AZIMUTH, ADD ° ′ ″ TO THE GEODETIC AZIMUTH

TO OBTAIN GRID AZ. (ADD)(SUB.) ° ′ ″ TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID) (MAGNETIC) ° ′ ″	BACK AZIMUTH ° ′ ″	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)

NOT SHOWN TO SCALE



A = 27.88'
B = 27.13'

0+00 ON PROFILE LINE IS MIDDLE PIPE

BASELINE STATION 341+47.07 IS LOCATED ABOUT 3.1 MI WEST OF THE HOLDEN BEACH FISHING PIER AND JUST EAST OF THE EAST SIDE OF THE CAMPING AREA.

N

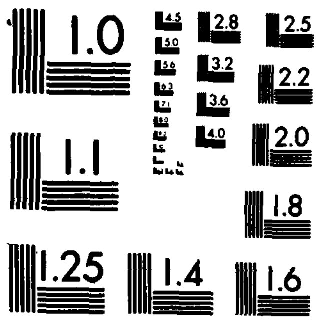
SKETCH

DA FORM 1 OCT 64 1959 REPLACES DA FORMS 1959 AND 1960, 1 FEB 57, WHICH ARE OBSOLETE.

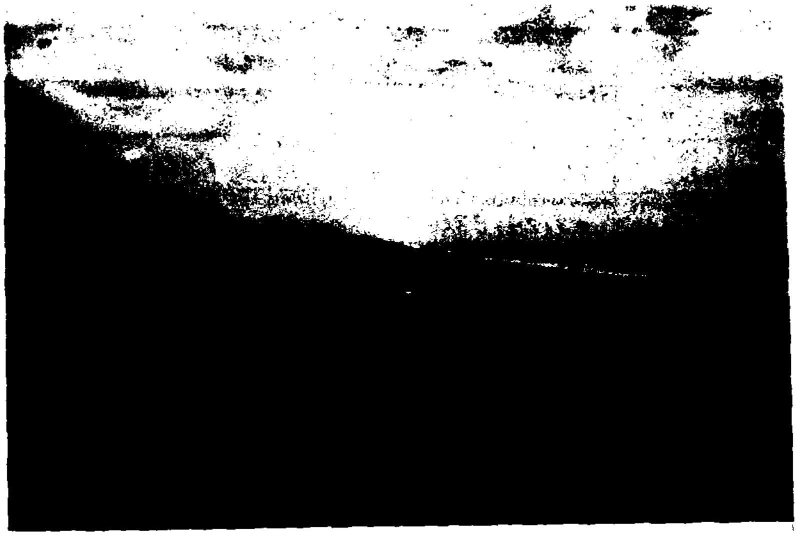
DESCRIPTION OR RECOVERY OF HORIZONTAL CONTROL STATION
For use of this form, see TM 5-237; the proponent agency is U.S.Continental Army Command

AD-A127 986 BEACH CHANGES AT HOLDEN BEACH NORTH CAROLINA 1970-74 2/3
(U) SCIENCE APPLICATIONS INC RALEIGH NC M C MILLER
MAR 83 CERC-MR-83-5 DACW72-79-C-0020

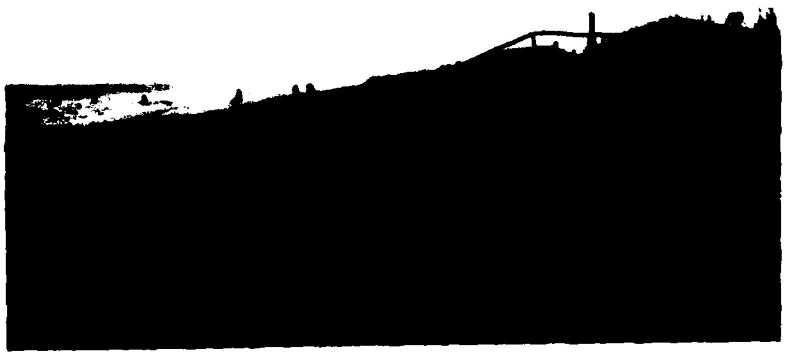
UNCLASSIFIED F/G 5/1 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A



Profile line 18. View toward east.



Profile line 18. View toward west.

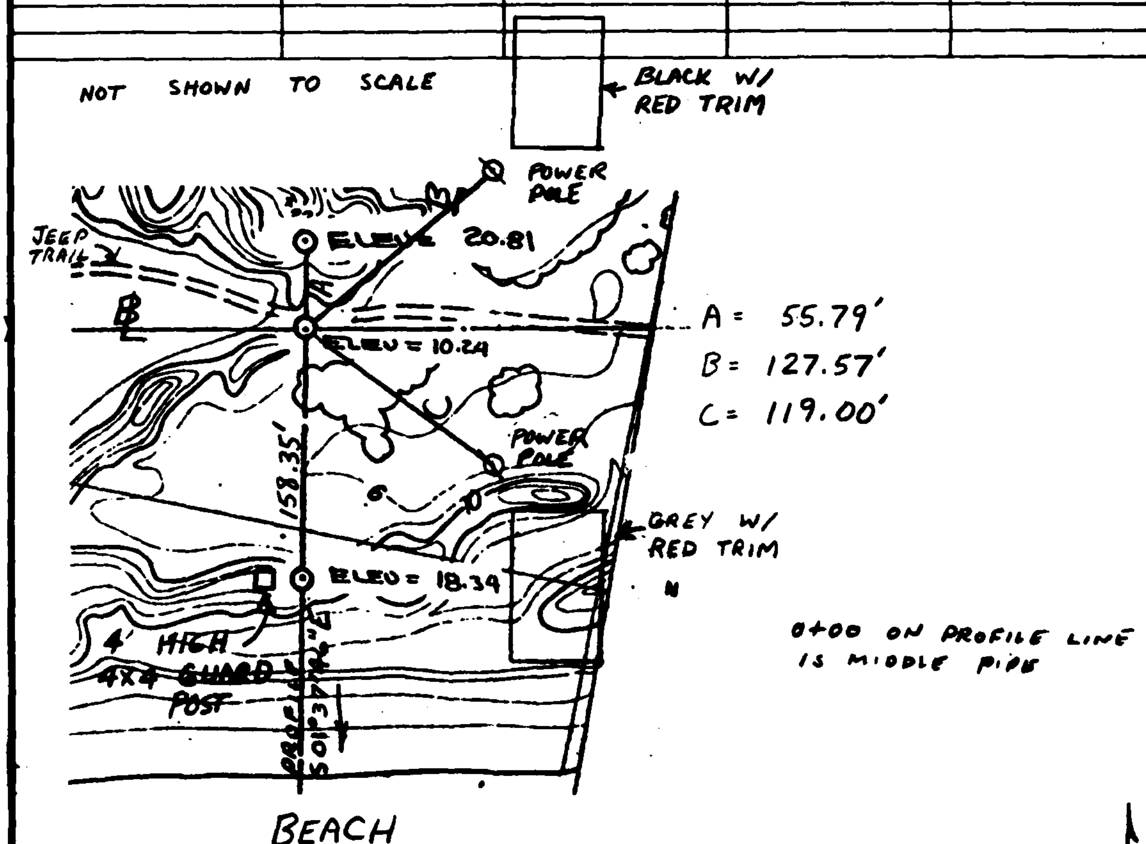
COUNTRY	TYPE OF MARK	STATION	
U.S.A.	GALV. PIPE	360+02.07 PROFILE 19	
LOCALITY	STAMPING ON MARK	AGENCY (CAST IN MARKS)	ELEVATION (FT) (M)
HOLDEN BEACH, N.C.	360+02.07	C.E.	10.24
LATITUDE	LONGITUDE	DATUM	DATUM
33-54-18.801	78-21-29.354	NORTH AMERICA 1927	1929 (M.S.L.)
~~(NORTHING)~~(EASTING) (FT) (M)	~~(EASTING)~~(NORTHING) (FT) (M)	GRID AND ZONE	ESTABLISHED BY (AGENCY)
2194790.180	57124.830	N.C. LAMBERT	CERC
(NORTHING)(EASTING) (FT) (M)	(EASTING)(NORTHING) (FT) (M)	GRID AND ZONE	DATE / ORDER
			1970 / THIRD

TO OBTAIN GRID AZIMUTH, ADD ° ' " TO THE GEODETIC AZIMUTH

TO OBTAIN GRID AZ. (ADD)(SUB.) ° ' " TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID) (MAGNETIC)	BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
	° ' "	° ' "		

NOT SHOWN TO SCALE



BASELINE STATION 360+02.07 IS LOCATED ABOUT 3.5 MILES WEST OF THE HOLDEN BEACH FISHING PIER, AND AT THE END OF THE PUBLIC ROAD, JUST WEST OF THE LAST TWO HOUSES.

SKETCH

DA FORM 1 OCT 64 1959 REPLACES DA FORMS 1959 AND 1960, 1 FEB 57, WHICH ARE OBSOLETE. DESCRIPTION OR RECOVERY OF HORIZONTAL CONTROL STATION
For use of this form, see TM 5-237; the proponent agency is U.S.Continental Army Command.

Profile line 19. View toward east.

Profile line 19. View toward west.

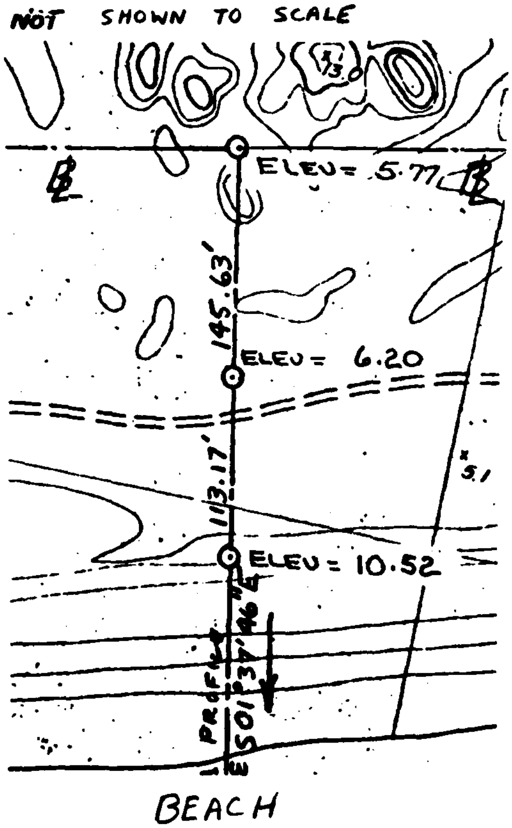
COUNTRY	TYPE OF MARK	STATION	
U. S. A.	GALV. PIPE	380+ 02.04	PROFILE 20
LOCALITY: HOLDEN BEACH, N.C.	STAMPING ON MARK: 380+02.04	AGENCY (CAST IN MARKS): C.E.	ELEVATION (FT)(M): 5.77
LATITUDE: 33-54-14.937	LONGITUDE: 78-21-52.621	DATUM: NORTH AMERICA 1927	DATUM: 1929 (M.S.L.)
~~(NORTHING)~~(EASTING) (FT)(M): 2192831.270	~~(EASTING)~~(NORTHING) (FT)(M): 56721.680	GRID AND ZONE: N.C. LAMBERT	ESTABLISHED BY (AGENCY): CERC
(NORTHING)(EASTING) (FT)(M):	(EASTING)(NORTHING) (FT)(M):	GRID AND ZONE:	DATE: 1970 / ORDER: THIRD

TO OBTAIN GRID AZIMUTH, ADD ° ' " TO THE GEODETIC AZIMUTH

TO OBTAIN GRID AZ. (ADD)(SUB.) ° ' " TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID)(MAGNETIC) ° ' "	BACK AZIMUTH ° ' "	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)

NOT SHOWN TO SCALE



0+00 ON PROFILE LINE IS NORTHERNMOST PIPE

NO PHYSICAL FEATURES TO TIE TO. STATION 380+02.04 IS LOCATED ABOUT 2000 FEET WEST OF THE LAST TWO HOUSES ON WEST END OF BEACH.

N

SKETCH

DA FORM 1 OCT 64 1959 REPLACES DA FORMS 1959 AND 1960, 1 FEB 57, WHICH ARE OBSOLETE.

DESCRIPTION OR RECOVERY OF HORIZONTAL CONTROL STATION
For use of this form, see TM 5-237; the proponent agency is U.S.Continental Army Command.

Profile line 20. View toward east.

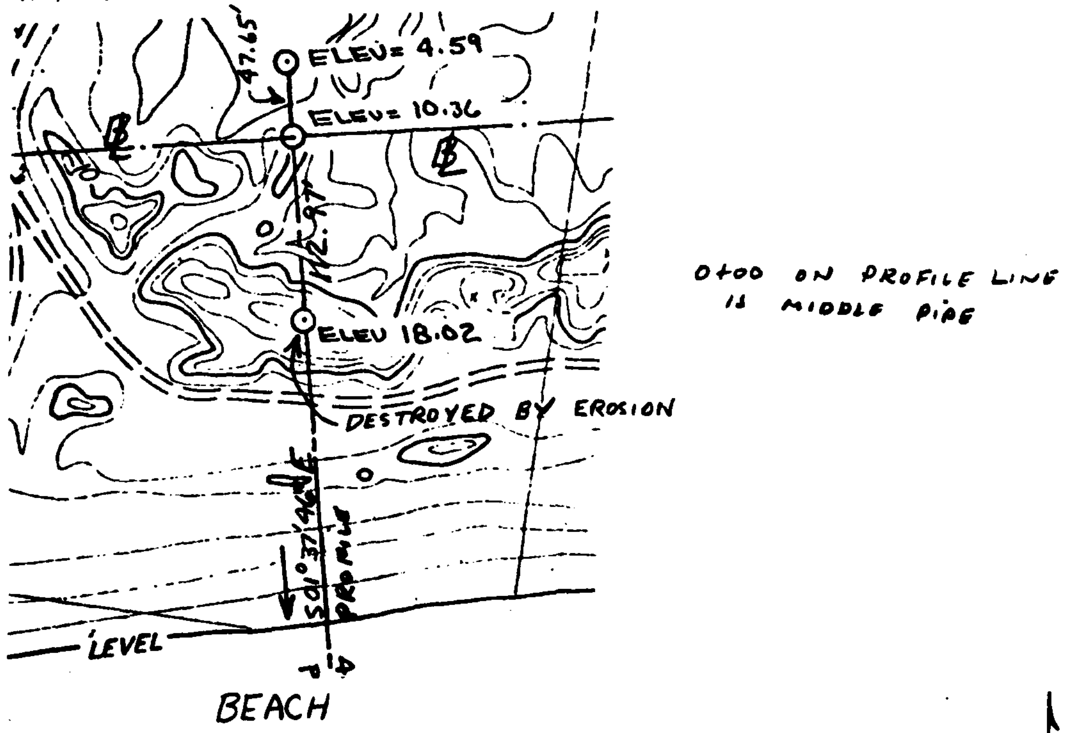
Profile line 20. View toward west.

COUNTRY	TYPE OF MARK	STATION	
U.S.A.	GALV. PIPE	400+50.61 PROFILE 21	
LOCALITY	STAMPING ON MARK	AGENCY (CAST IN MARKS)	ELEVATION (FT) (M)
HOLDEN BEACH, N.C.	400+50.61	C.E.	10.36
LATITUDE	LONGITUDE	DATUM	DATUM
33-54-10.979	78-22-16.454	NORTH AMERICA 1927	1929 (M.S.L.)
~~(NORTHING)~~(EASTING) (FT) (M)	~~(EASTING)~~(NORTHING) (FT) (M)	GRID AND ZONE	ESTABLISHED BY (AGENCY)
2190824.750	56308.720	N.C. LAMBERT	CERC
(NORTHING)(EASTING) (FT) (M)	(EASTING)(NORTHING) (FT) (M)	GRID AND ZONE	DATE 1970 / ORDER THIRD

TO OBTAIN	GRID AZIMUTH, ADD ° ′ ″	TO THE GEODETIC AZIMUTH
TO OBTAIN	GRID AZ. (ADD)(SUB.) ° ′ ″	TO THE GEODETIC AZIMUTH

OBJECT	AZIMUTH OR DIRECTION (GEODETIC)(GRID) (MAGNETIC)	BACK AZIMUTH	GEOD. DISTANCE (METERS) (FEET)	GRID DISTANCE (METERS) (FEET)
	° ′ ″	° ′ ″		

NOT SHOWN TO SCALE



0+00 ON PROFILE LINE IS MIDDLE PIPE

BASELINE STATION 400+50.61 IS LOCATED ABOUT 0.8 MILE WEST OF THE LAST TWO HOUSES ON HOLDEN BEACH, THERE ARE NO PHYSICAL FEATURES TO TIE TO.

SKETCH

DA FORM 1 OCT 64 1959 REPLACES DA FORMS 1959 AND 1960, 1 FEB 57, WHICH ARE OBSOLETE.

DESCRIPTION OR RECOVERY OF HORIZONTAL CONTROL STATION
For use of this form, see TM 5-237; the proponent agency is U.S.Continental Army Command.

Profile line 21. View toward east.

Profile line 21. View toward west across Shallotte Inlet.

APPENDIX B

BEACH PROFILE DATA

This appendix provides the edited beach profile data for each profile line measured during the study period from November 1970 to December 1974. The benchmark used for each profile line is indicated by the zero with positive distances in the seaward direction. The vertical measurements were referenced to the National Geodetic Vertical Datum of 1929. All distances and elevations are in feet.

The heading of each data column provides the year (yy), month (mm), and day (dd) of the measurement in the format yymmdd, as well as the survey number.

LINE 1

DATE	701112	DATE	701214	DATE	710118	DATE	710208	DATE	710309	DATE	710408	DATE	710510	DATE	710607
SRVY	2	SRVY	3	SRVY	4	SRVY	5	SRVY	6	SRVY	7	SRVY	8	SRVY	9
94.	5.9	94.	5.6	94.	4.8	0.	11.4	0.	11.3	0.	11.4	0.	11.3	-68.	8.1
100.	5.7	113.	5.3	100.	4.3	17.	6.5	4.	10.9	13.	6.8	5.	10.4	-33.	5.3
125.	4.6	134.	5.5	125.	2.8	25.	6.3	13.	6.6	25.	5.3	9.	8.2	-13.	5.6
150.	3.8	160.	2.6	150.	1.0	50.	6.0	25.	6.3	50.	3.1	25.	2.6	0.	9.6
175.	3.1	185.	1.4	175.	-.6	73.	5.9	50.	5.7	75.	1.0	50.	.5	7.	5.0
200.	2.4	200.	.7	200.	-1.5	86.	3.6	75.	2.7	100.	-.4	75.	-1.2	25.	2.5
225.	1.3	228.	-.7	225.	-2.0	93.	2.7	100.	.8	125.	-1.4	100.	-1.8	50.	.3
250.	.3	250.	-2.1	250.	-1.9	100.	2.2	125.	-.5	150.	-1.6	125.	-2.1	75.	.1
275.	-1.4	275.	-2.4	275.	-2.1	125.	.8	150.	-1.3	175.	-1.7	140.	-2.0	100.	-1.8
300.	-1.7	300.	-1.9	300.	-2.5	150.	-.4	175.	-1.7	200.	-2.0			125.	-2.0
325.	-1.5	325.	-1.6			175.	-2.0	200.	-1.9	225.	-1.9			150.	-2.1
350.	-2.2	350.	-1.6			200.	-2.3	225.	-2.1	250.	-1.8			175.	-2.1
375.	-3.3	375.	-2.3			225.	-2.2	250.	-2.2	275.	-1.5			200.	-2.2
		400.	-3.5			250.	-2.3	275.	-2.6	300.	-2.4			225.	-2.4
						275.	-2.5	300.	-3.1					250.	-2.7

LINE 1

DATE	710809	DATE	710831	DATE	711006	DATE	711214	DATE	720103	DATE	720208	DATE	720320	DATE	720413
SRVY	10	SRVY	11	SRVY	12	SRVY	13	SRVY	14	SRVY	15	SRVY	16	SRVY	17
-68.	8.3	-68.	8.3	-68.	8.2	-68.	8.2	-68.	8.1	-68.	8.2	-68.	8.3	-68.	8.3
-61.	6.6	-60.	6.3	-60.	6.6	-61.	8.5	-59.	6.3	-61.	6.4	-55.	5.8	-58.	6.4
-34.	5.0	-41.	5.0	-39.	5.0	-40.	5.0	-39.	8.9	-43.	5.3	-48.	6.8	-51.	6.0
-22.	6.1	-18.	6.0	-29.	5.2	-14.	8.3	-16.	6.5	-28.	5.5	-42.	5.1	-49.	7.0
-13.	7.7	-13.	7.9	-17.	5.9	-11.	7.0	-12.	8.1	-16.	6.7	-17.	7.1	-44.	5.2
-9.	6.4	0.	5.3	-12.	7.5	0.	6.8	-10.	7.0	0.	6.7	-13.	8.1	-18.	6.6
0.	5.6	25.	3.4	-8.	6.9	25.	4.6	0.	6.8	25.	6.0	-9.	7.1	-14.	8.1
25.	2.6	50.	1.0	0.	6.5	45.	3.6	24.	5.6	50.	5.4	0.	6.6	-8.	7.2
50.	.4	75.	-.4	25.	5.6	70.	4.0	50.	3.7	75.	4.1	25.	6.1	0.	7.0
50.	-.4	84.	-.9	32.	5.0	95.	1.9	75.	2.2	100.	2.1	50.	3.9	25.	5.6
60.	-.3	100.	-1.1	50.	3.9	120.	.2	100.	1.2	125.	.3	75.	2.5	50.	4.0
80.	-.4	125.	-1.2	75.	2.9	145.	-1.1	125.	-.4	150.	-1.3	100.	1.4	75.	2.2
87.	-1.1	150.	-1.2	100.	1.7	170.	-1.5	150.	-1.7	175.	-2.2	125.	.3	100.	1.2
		175.	-1.2	125.	.3	195.	-1.7	175.	-2.1	200.	-2.2	150.	-1.6	125.	-1.0
		200.	-1.5	150.	-.6	200.	-1.8	190.	-2.6	225.	-2.2	175.	-1.8	150.	-1.9
		225.	-1.9	175.	-.9	225.	-1.8					200.	-2.5	175.	-2.2
		250.	-2.1	200.	-1.9	250.	-1.9							200.	-2.2
		275.	-2.3	225.	-2.1	275.	-1.7							225.	-2.3
		300.	-2.4	235.	-2.4	300.	-1.3							250.	-2.3
		325.	-2.5	245.	-2.6	325.	-.8							275.	-2.5
						350.	-.7								
						375.	-1.7								
						400.	-1.9								
						425.	-2.3								
						450.	-2.5								
						475.	-2.7								

LINE 1

DATE 720609		DATE 720625		DATE 720805		DATE 720929		DATE 721211		DATE 730115		DATE 730215		DATE 730315	
SRVY	18	SRVY	19	SRVY	20	SRVY	21	SRVY	22	SRVY	23	SRVY	24	SRVY	25
----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------
-68.	8.4	-68.	8.4	-68.	8.2	-68.	8.3	-68.	8.3	-68.	8.2	-68.	8.2	-68.	8.3
-59.	6.3	-61.	6.5	-53.	5.9	-56.	6.0	-57.	6.4	-63.	6.6	-62.	8.0	-62.	7.2
-52.	6.0	-53.	5.9	-48.	6.8	-29.	5.5	-35.	5.2	-48.	6.3	-33.	5.2	-40.	5.7
-48.	6.6	-47.	6.4	-40.	5.2	-13.	4.8	0.	3.7	-28.	4.9	0.	3.9	-25.	5.1
-41.	5.4	-43.	5.5	-39.	4.3	0.	4.0	25.	2.5	0.	4.0	25.	2.8	0.	4.2
-30.	5.6	-19.	6.6	-19.	1.9	25.	2.0	50.	1.3	25.	3.0	50.	1.6	25.	3.0
-17.	6.8	-16.	8.2	0.	1.0	50.	.3	75.	.1	50.	1.5	75.	.3	50.	1.3
-13.	8.0	-8.	7.2	25.	0.0	62.	-.1	100.	-.9	75.	-1.7	100.	-1.1	75.	-.6
-6.	7.1	0.	6.7	50.	-.1	67.	-1.3	125.	-2.2	100.	-2.4	125.	-2.8	100.	-2.2
0.	7.1	13.	5.9	75.	-.3	77.	-2.4	150.	-2.6	125.	-2.7	150.	-3.3	125.	-3.5
9.	6.9	36.	2.8	76.	-1.1	100.	-2.7	175.	-3.0	150.	-3.1	175.	-1.7	150.	-4.2
34.	5.4	60.	1.2	100.	-2.5	125.	-2.3	200.	-3.2	175.	-3.4	200.	-.8		
60.	2.8	81.	.2	125.	-3.0	150.	-2.0	225.	-1.4	200.	-4.0	225.	-2.0		
75.	1.4	100.	-.8	150.	-2.9	175.	-2.8	250.	-2.1			250.	-3.4		
100.	0.0	125.	-1.8	175.	-2.7	200.	-3.2	275.	-2.6						
125.	-1.6	150.	-2.2	200.	-2.7	225.	-2.7								
150.	-2.2	175.	-1.8	225.	-2.6	250.	-2.5								
175.	-2.5	200.	-1.1	250.	-2.1										
200.	-2.2	225.	-1.1	275.	-2.0										
225.	-1.9	250.	-2.4	300.	-2.7										
250.	-2.1			325.	-3.6										
275.	-2.4			350.	-4.8										
283.	-2.9														

LINE 1

DATE 730328		DATE 730413		DATE 730614		DATE 730712		DATE 730809		DATE 731008		DATE 731205		DATE 740107	
SRVY	26	SRVY	27	SRVY	28	SRVY	29	SRVY	30	SRVY	31	SRVY	32	SRVY	33
----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------
-68.	8.3	-68.	8.3	-68.	9.0	-68.	9.4	-68.	9.5	-68.	8.5	-65.	9.4	-68.	9.6
-45.	6.0	-49.	6.7	-43.	6.2	-51.	7.1	-60.	8.6	-64.	5.9	-62.	6.6	-34.	5.8
-17.	4.0	-31.	5.1	-41.	4.5	-48.	5.4	-55.	4.6	-43.	4.5	-37.	5.4	-13.	5.7
0.	4.1	-13.	4.7	-18.	4.0	-38.	4.5	-43.	2.9	-21.	4.3	-20.	5.4	0.	4.5
25.	3.1	0.	3.9	0.	4.0	-18.	2.9	-18.	2.2	-5.	4.3	0.	5.2	25.	2.6
50.	1.9	25.	3.0	25.	2.8	0.	2.7	0.	2.1	0.	4.1	25.	4.1	50.	.8
75.	.1	50.	1.9	50.	1.0	25.	1.6	25.	.8	21.	3.5	50.	2.6	75.	-.9
100.	-2.0	75.	1.2	75.	-1.6	55.	.2	50.	-1.4	25.	3.4	75.	.8	100.	-2.1
114.	-3.0	100.	-.4	100.	-2.6	75.	-2.6	75.	-3.0	50.	2.0	100.	-1.4	125.	-3.2
		125.	-2.2			100.	-2.8			75.	0.0	125.	-2.1		
		150.	-3.8							100.	-2.3	150.	-2.9		
										125.	-2.8				

LINE 1

DATE	740204	DATE	740308	DATE	740401	DATE	740530	DATE	740816	DATE	740930	DATE	741203
SRVY	34	SRVY	35	SRVY	36	SRVY	37	SRVY	38	SRVY	39	SRVY	40
-68.	10.1	-68.	8.8	-68.	8.6	-68.	8.8	-68.	9.2	-68.	9.7	-68.	9.6
-64.	7.5	-65.	6.8	-64.	7.1	-49.	6.5	-50.	6.6	-60.	7.6	-64.	8.5
-50.	7.2	-43.	5.6	-44.	5.9	-30.	5.4	-25.	5.9	-35.	6.1	-59.	7.8
-35.	7.1	-17.	4.4	-22.	5.1	-13.	5.6	0.	5.6	-10.	4.8	-58.	6.8
0.	5.3	0.	3.8	0.	4.9	0.	4.9	15.	5.4	0.	4.1	-35.	5.0
25.	3.8	25.	2.9	25.	4.1	22.	4.5	40.	3.7	25.	2.9	-10.	3.8
50.	2.5	50.	2.1	50.	2.7	47.	2.1	55.	2.3	50.	1.6	0.	3.3
75.	.0	75.	1.1	75.	2.0	80.	1.0	86.	.4	75.	.3	25.	2.4
100.	-.3	100.	-.7	100.	1.8	100.	-.4	100.	-.3	100.	-1.2	50.	1.6
125.	-.8	125.	-2.8	115.	1.3	125.	-1.5	125.	-.9	125.	-1.8	75.	.3
150.	-2.3			140.	-.5	150.	-2.5	150.	-1.8	150.	-2.6	100.	-1.3
165.	-3.0			165.	-1.4			175.	-3.5			125.	-2.0
				185.	-2.3							150.	-2.9

LINE 2

DATE	701112	DATE	701214	DATE	710114	DATE	710208	DATE	710309	DATE	710408	DATE	710510	DATE	710607
SRVY	2	SRVY	3	SRVY	4	SRVY	5	SRVY	6	SRVY	7	SRVY	8	SRVY	9
0.	9.4	0.	9.3	0.	9.3	0.	9.3	0.	9.3	0.	9.3	0.	9.3	0.	9.2
19.	9.2	19.	9.2	19.	9.2	19.	9.2	19.	9.2	19.	9.1	19.	9.1	19.	9.1
40.	9.8	33.	9.1	34.	9.1	33.	9.1	32.	9.0	31.	9.0	31.	8.9	25.	9.0
42.	7.0	40.	10.3	36.	8.0	35.	6.7	35.	7.6	34.	7.9	35.	7.9	48.	7.9
75.	3.2	41.	7.1	58.	5.0	39.	6.1	50.	8.1	50.	8.2	50.	8.2	75.	9.2
100.	1.6	67.	3.7	75.	2.6	41.	4.6	75.	9.4	75.	9.3	75.	9.2	100.	8.4
125.	-.2	90.	1.9	100.	.1	50.	4.9	100.	8.6	100.	8.6	100.	8.4	125.	9.0
150.	-1.5	100.	1.2	125.	-.1	75.	4.9	125.	9.5	125.	9.0	125.	9.0	153.	9.6
161.	-1.5	125.	-.4	150.	-.3	100.	4.5	150.	9.8	150.	10.1	150.	9.7	158.	5.1
185.	-.7	150.	.1	175.	-.8	125.	3.7	175.	9.0	161.	10.3	156.	9.4	178.	3.6
200.	-.7	175.	-.2	200.	-1.1	150.	2.2	192.	7.9	164.	6.0	160.	5.5	200.	2.2
225.	-1.2	200.	-.8	225.	-1.6	175.	1.0	200.	2.4	175.	4.5	175.	3.6	225.	1.0
250.	-1.9	225.	-1.6	250.	-2.1	200.	-.1	225.	.3	200.	1.6	200.	2.2	250.	.2
275.	-2.7	250.	-2.3	275.	-2.5	225.	-.9	250.	-.5	225.	.4	225.	1.0	275.	-.5
		275.	-3.1	300.	-2.9	250.	-1.5	275.	-2.1	250.	-.6	250.	-.8	300.	-1.2
						275.	-2.1	300.	-3.3	275.	-1.4	275.	-1.9	325.	-2.2
						300.	-2.5			300.	-2.0	288.	-2.6	350.	-2.7
						325.	-3.2			325.	-2.4				
										350.	-2.5				
										375.	-2.8				

LINE 2

DATE	710809	DATE	710831	DATE	711006	DATE	711214	DATE	720103	DATE	720208	DATE	720317	DATE	720413
SRVY	10	SRVY	11	SRVY	12	SRVY	13	SRVY	14	SRVY	15	SRVY	16	SRVY	17
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0.	9.3	0.	9.1	0.	9.1	0.	9.2	0.	9.3	0.	9.3	52.	8.2	52.	8.4
19.	9.1	18.	9.1	19.	9.1	19.	9.1	19.	9.1	19.	9.1	77.	9.2	77.	9.4
32.	8.8	33.	8.6	39.	8.7	39.	8.7	38.	8.7	39.	8.8	101.	8.4	100.	8.7
45.	8.0	48.	8.0	41.	8.0	45.	7.9	42.	8.1	43.	8.2	118.	8.4	125.	8.5
74.	9.2	67.	9.3	66.	9.1	70.	9.1	67.	9.2	68.	9.4	150.	9.5	150.	9.7
82.	9.3	92.	8.7	79.	9.3	83.	9.5	92.	8.9	93.	9.0	176.	3.4	154.	7.2
100.	8.4	100.	8.5	100.	8.4	100.	8.5	100.	8.5	100.	8.6	200.	1.7	175.	3.3
111.	8.2	120.	8.5	125.	8.9	125.	9.2	125.	9.0	125.	9.3	225.	.8	200.	1.7
139.	9.0	145.	9.7	150.	9.5	150.	9.5	150.	9.5	150.	9.4	250.	-.1	225.	1.0
153.	9.4	154.	9.4	157.	9.3	153.	7.4	155.	7.4	175.	4.5	275.	-.6	250.	.5
159.	6.2	159.	6.4	162.	6.5	175.	5.6	167.	6.4	200.	2.5	300.	-1.0	275.	-.2
175.	5.0	184.	4.1	187.	5.7	200.	3.8	192.	3.2	225.	.8	325.	-1.4	300.	-.8
200.	2.0	200.	3.4	200.	5.1	225.	2.3	200.	2.5	250.	-.1	350.	-1.7	325.	-1.3
225.	.4	225.	2.9	225.	3.4	250.	.8	225.	1.3	275.	-.7	375.	-1.9	350.	-1.7
250.	-.5	250.	2.7	250.	1.4	275.	.1	250.	.4	300.	-1.1	400.	-2.7	375.	-2.1
275.	-.6	275.	1.9	275.	-.2	300.	-.6	275.	-.3	325.	-1.5			400.	-2.8
300.	-.8	300.	1.1	300.	-1.1	325.	-1.4	300.	-.9	350.	-1.9				
315.	-1.2	325.	.5	325.	-.2	350.	-2.1	325.	-1.4	375.	-2.4				
		350.	-.1	350.	-.3	375.	-2.6	350.	-1.9	400.	-3.0				
		375.	-.7	375.	-.9	400.	-3.5	375.	-2.6						
		400.	-1.4	400.	-1.6										
		425.	-2.1	425.	-2.6										
		450.	-2.9												

LINE 2

DATE	720609	DATE	720622	DATE	720805	DATE	720929	DATE	721211	DATE	730115	DATE	730215	DATE	730315
SRVY	18	SRVY	19	SRVY	20	SRVY	21	SRVY	22	SRVY	23	SRVY	24	SRVY	25
----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------
53.	8.3	52.	8.4	52.	8.4	52.	8.4	52.	8.7	52.	8.6	52.	8.5	52.	8.4
78.	9.2	77.	9.3	77.	9.4	77.	9.2	77.	9.5	77.	9.4	77.	9.3	77.	9.4
100.	8.6	100.	8.9	100.	8.7	100.	8.7	100.	9.1	100.	8.3	100.	8.5	100.	8.8
125.	8.6	114.	8.3	113.	8.2	118.	8.1	125.	8.4	125.	8.5	113.	8.1	112.	8.2
140.	9.2	139.	9.3	136.	9.0	134.	8.6	150.	7.1	138.	7.3	137.	8.6	136.	8.5
149.	6.1	156.	5.3	160.	4.0	159.	5.3	175.	6.3	150.	6.4	162.	6.8	165.	6.6
175.	3.8	182.	2.8	183.	2.3	176.	4.5	200.	6.9	175.	5.8	200.	4.2	200.	5.1
200.	2.4	200.	1.5	200.	1.8	200.	4.7	217.	6.5	200.	5.0	225.	2.7	225.	2.7
225.	1.8	225.	.6	208.	1.7	225.	5.2	240.	3.1	225.	2.3	250.	1.6	250.	1.4
250.	.9	250.	.1	230.	.8	250.	5.8	270.	.9	250.	1.1	275.	.6	275.	.5
275.	-.1	275.	-.7	255.	-1.2	262.	5.9	300.	-.2	275.	.1	300.	0.0	300.	-.5
300.	-1.0	300.	-1.2	280.	-2.1	278.	3.9	325.	-2.0	300.	-.4	335.	-.6	325.	-1.3
325.	-1.9	325.	-1.2	300.	-2.7	300.	2.5	350.	-2.0	325.	-.9	350.	-1.3	350.	-2.0
350.	-2.6	350.	-2.1			325.	1.1	375.	-2.3	350.	-1.8	375.	-2.2	375.	-2.6
375.	-3.3	375.	-2.7			350.	-.1	400.	-2.7	375.	-2.2	400.	-2.9		
						375.	-1.3			400.	-2.7				
						400.	-2.5								

LINE 2

DATE 730328 SRVY 26		DATE 730413 SRVY 27		DATE 730614 SRVY 28		DATE 730712 SRVY 29		DATE 730809 SRVY 30		DATE 731008 SRVY 31		DATE 731205 SRVY 32		DATE 740107 SRVY 33	
52.	8.4	52.	8.6	52.	8.6	52.	8.5	52.	8.5	52.	8.5	52.	8.7	52.	8.6
77.	9.2	77.	9.2	77.	9.3	77.	9.1	77.	9.2	77.	9.2	75.	9.1	77.	9.4
100.	8.0	100.	8.6	100.	8.9	100.	8.7	100.	8.9	100.	8.6	100.	8.6	100.	8.9
112.	8.3	125.	8.3	125.	8.2	125.	8.1	125.	8.0	125.	8.1	127.	8.7	125.	8.3
134.	8.3	136.	8.6	135.	8.6	139.	8.4	150.	6.7	134.	8.6	150.	6.5	137.	8.6
160.	6.6	148.	7.3	148.	7.1	150.	6.8	175.	4.2	144.	7.2	155.	6.0	159.	6.3
183.	5.0	173.	4.9	173.	4.5	175.	4.8	200.	2.3	150.	6.7	175.	6.5	196.	6.2
200.	4.0	200.	3.1	200.	2.9	200.	3.3	225.	1.0	175.	5.3	193.	6.6	200.	5.8
223.	2.6	225.	2.0	225.	1.6	225.	2.1	250.	.5	200.	5.8	200.	6.2	225.	4.3
250.	1.5	250.	1.2	250.	.8	250.	1.1	275.	-.6	215.	6.0	225.	3.9	250.	2.4
275.	.6	275.	.5	275.	.1	275.	-.6	300.	-1.9	225.	5.0	250.	2.6	280.	1.0
300.	-.2	300.	-.2	300.	-.4	300.	-2.0	325.	-3.2	250.	3.0	275.	1.6	300.	-.7
325.	-.7	325.	-.7	325.	-1.6	325.	-2.6			275.	2.0	300.	.7	325.	-2.2
350.	-1.1	350.	-1.3	350.	-2.6					300.	.8	325.	-.6	350.	-3.1
375.	-1.6	375.	-1.8	375.	-3.4					325.	-.7	350.	-1.7		
400.	-2.2	400.	-3.7							350.	-.9	375.	-2.9		
425.	-2.7									375.	-1.8				
										400.	-2.8				

LINE 2

DATE 740204 SRVY 34		DATE 740304 SRVY 35		DATE 740401 SRVY 36		DATE 740530 SRVY 37		DATE 740816 SRVY 38		DATE 740930 SRVY 39		DATE 741203 SRVY 40	
52.	8.6	52.	8.9	52.	8.5	52.	8.6	0.	9.5	0.	9.2	0.	9.3
77.	9.3	77.	9.3	77.	9.1	77.	9.2	9.	9.1	20.	9.3	20.	9.3
100.	8.7	100.	8.7	100.	8.6	100.	8.9	20.	9.3	45.	8.9	30.	9.0
125.	8.2	125.	8.8	120.	8.0	125.	8.2	30.	9.1	70.	9.4	55.	9.1
134.	8.6	150.	8.6	138.	8.4	150.	7.8	52.	9.0	95.	9.1	76.	9.5
155.	6.4	160.	6.1	162.	5.7	168.	5.7	75.	9.5	100.	8.9	100.	8.8
190.	6.5	180.	3.8	183.	4.9	192.	3.4	100.	8.9	125.	8.3	125.	8.4
200.	5.2	200.	2.7	200.	2.9	200.	2.7	125.	8.4	135.	8.5	148.	7.4
225.	2.2	225.	1.2	225.	1.2	225.	1.8	133.	8.7	150.	7.1	171.	8.0
250.	1.0	250.	.5	250.	.5	250.	1.1	148.	7.2	175.	7.8	200.	8.7
275.	-.3	275.	-.6	275.	-.1	275.	.5	175.	7.8	200.	8.7	203.	8.6
300.	-1.1	300.	-1.4	300.	-.9	300.	0.0	200.	8.8	225.	9.9	207.	7.7
325.	-2.4	325.	-1.6	325.	-1.5	325.	-.4	225.	10.2	250.	10.9	209.	4.8
		350.	-1.5	350.	-1.4	350.	-.8	250.	11.0	255.	10.8	234.	2.1
		375.	-1.9	375.	-1.5	375.	-1.0	275.	9.9	262.	4.7	250.	1.0
		400.	-2.4	400.	-1.9	400.	-1.6	300.	8.5	278.	2.2	275.	.7
				425.	-2.3	425.	-2.3	325.	1.6	300.	.7	300.	.1
						450.	-2.7	350.	.2	325.	0.0	325.	.1
								375.	-.7	350.	-.4	350.	-.8
								400.	-1.6	375.	-.9	375.	-2.6
								425.	-2.4	400.	-1.8	400.	-3.6
								450.	-3.3	425.	-2.8		

LINE 3

DATE 701112 SRVY 2		DATE 701214 SRVY 3		DATE 710114 SRVY 4		DATE 710208 SRVY 5		DATE 710309 SRVY 6		DATE 710408 SRVY 7		DATE 710510 SRVY 8		DATE 710607 SRVY 9	
112.	13.3	112.	13.2	112.	13.4	112.	13.1	112.	13.1	112.	12.9	112.	13.0	112.	12.9
130.	13.8	117.	13.1	131.	13.6	125.	13.9	121.	13.7	125.	13.8	121.	13.6	122.	13.5
136.	8.1	119.	13.7	140.	5.4	131.	13.2	125.	13.9	134.	4.2	132.	4.4	132.	8.2
145.	3.8	131.	13.3	157.	2.2	142.	5.2	131.	13.3	150.	2.6	150.	2.1	150.	2.8
170.	.8	143.	4.4	182.	.6	155.	2.4	139.	5.1	175.	1.0	175.	1.0	175.	.9
195.	.3	157.	1.9	200.	.9	167.	3.3	150.	3.2	200.	.1	200.	.3	200.	.4
200.	.1	182.	1.2	225.	1.1	175.	2.1	175.	1.9	225.	-.5	225.	-.5	225.	.2
225.	-.4	200.	.7	250.	.6	200.	.7	200.	.6	250.	-.9	250.	-.9	250.	-.3
250.	-1.1	225.	.3	275.	-.2	225.	0.0	225.	-.2	275.	-1.3	275.	-1.4	275.	-.8
275.	-.8	250.	-.2	300.	-1.4	250.	-.4	250.	-.8	300.	-1.7	300.	-1.7	300.	-1.3
300.	-1.3	275.	-.6	325.	-2.7	275.	-.4	275.	-1.3	325.	-2.2	325.	-2.0	325.	-1.9
325.	-2.1	300.	-1.2			300.	-.7	300.	-1.9	350.	-2.7	345.	-2.2	350.	-2.6
350.	-2.8	325.	-1.9			325.	-1.3	325.	-2.5						
		350.	-2.8			350.	-2.4								
						375.	-4.3								

LINE 3

DATE 710809 SRVY 10		DATE 710831 SRVY 11		DATE 711006 SRVY 12		DATE 711214 SRVY 13		DATE 720103 SRVY 14		DATE 720208 SRVY 15		DATE 720317 SRVY 16		DATE 720413 SRVY 17	
112.	13.0	112.	12.9	112.	13.0	112.	13.0	112.	13.0	112.	12.9	112.	13.0	112.	13.1
120.	13.4	120.	13.4	120.	13.4	119.	13.4	119.	13.1	118.	13.2	118.	13.4	118.	13.2
122.	10.5	130.	5.3	129.	5.9	128.	5.9	128.	5.9	129.	5.8	129.	6.1	128.	6.1
131.	5.3	150.	5.3	154.	5.7	153.	6.6	153.	6.5	155.	6.5	155.	6.8	152.	6.7
150.	4.7	175.	3.2	176.	6.4	178.	6.5	178.	6.4	180.	6.5	176.	6.6	167.	6.5
157.	4.2	200.	1.9	200.	3.5	189.	5.9	188.	6.1	200.	4.7	200.	6.9	189.	4.5
174.	1.7	225.	.9	225.	1.8	200.	4.6	200.	4.5	225.	2.7	225.	2.1	200.	3.0
200.	.3	250.	.4	234.	1.2	225.	3.6	225.	2.2	250.	1.2	250.	2.1	225.	1.7
225.	1.0	275.	-.3	250.	1.0	250.	1.8	250.	1.1	275.	.4	275.	.2	250.	.9
250.	.1	300.	-1.3	275.	.5	275.	.4	275.	.1	300.	-.2	300.	-.5	275.	.1
275.	-1.3	325.	-2.4	300.	-.4	300.	-.4	300.	-.6	325.	-1.1	325.	-1.0	300.	-.5
300.	-2.2	350.	-3.3	325.	-1.5	325.	-1.2	325.	-1.0	350.	-2.1	350.	-1.4	325.	-1.3
				350.	-2.7	350.	-2.5	350.	-1.8	375.	-3.0	375.	-2.4	350.	-1.8
								375.	-2.9					375.	-2.5
														400.	-3.0

LINE 3

DATE 720609 SRVY 18		DATE 720622 SRVY 19		DATE 720805 SRVY 20		DATE 720929 SRVY 21		DATE 721211 SRVY 22		DATE 730115 SRVY 23		DATE 730215 SRVY 24		DATE 730315 SRVY 25	
112.	13.0	112.	13.1	112.	13.1	112.	13.1	112.	13.1	112.	13.1	112.	13.2	112.	13.3
118.	13.2	118.	13.2	118.	13.2	118.	13.1	118.	13.2	117.	13.1	118.	13.2	121.	13.2
128.	6.6	127.	6.7	129.	6.2	128.	6.2	130.	6.2	129.	6.2	129.	6.2	129.	6.3
156.	6.5	155.	6.8	155.	6.8	155.	6.7	150.	6.8	150.	6.8	154.	7.5	156.	7.1
181.	4.4	183.	3.7	175.	4.2	166.	6.5	175.	6.3	170.	6.6	179.	3.2	183.	3.9
200.	3.2	200.	2.9	200.	3.2	187.	3.0	200.	5.1	200.	3.7	208.	1.8	200.	2.3
225.	2.1	225.	1.5	225.	2.0	200.	1.9	225.	3.5	225.	1.8	233.	.8	225.	1.0
250.	1.5	250.	.6	250.	.6	225.	.7	250.	2.0	250.	1.0	258.	.3	250.	.7
275.	.8	275.	-.1	275.	-.8	250.	.4	275.	1.0	275.	.5	276.	-.3	275.	.4
300.	-.1	288.	.1	285.	-1.0	275.	.2	300.	.3	300.	0.0	308.	-.7	300.	0.0
325.	-.6	300.	-.4	300.	-.4	300.	-.3	325.	-.3	325.	-.6	333.	-1.2	325.	-.6
350.	-1.6	325.	-1.7	325.	-.7	325.	-.8	350.	-.9	350.	-1.1	358.	-1.6	350.	-1.3
375.	-2.4	350.	-2.7	350.	-1.5	350.	-1.5	375.	-1.4	375.	-2.0	383.	-2.0	375.	-1.9
400.	-2.9	375.	-1.8	375.	-2.4	375.	-2.3	400.	-2.4	400.	-2.4	408.	-2.1	400.	-2.6
		400.	-2.1	400.	-2.9	400.	-3.2	425.	-3.0	425.	-3.0	433.	-2.4		
		425.	-2.6									458.	-3.0		

LINE 3

DATE 730328 SRVY 26		DATE 730413 SRVY 27		DATE 730614 SRVY 28		DATE 730712 SRVY 29		DATE 730809 SRVY 30		DATE 731008 SRVY 31		DATE 731205 SRVY 32		DATE 740107 SRVY 33	
112.	13.3	112.	13.1	112.	13.0	112.	13.2	112.	13.0	112.	13.1	112.	13.2	112.	13.2
117.	13.2	119.	13.2	117.	13.1	117.	13.1	118.	13.0	117.	13.2	115.	13.0	117.	12.9
129.	6.3	129.	6.4	134.	6.3	131.	6.2	129.	6.6	128.	6.9	127.	6.0	129.	6.7
149.	6.1	157.	5.1	154.	5.8	157.	5.9	157.	5.8	153.	5.9	150.	6.1	153.	6.4
174.	4.3	177.	3.8	182.	4.4	187.	5.7	187.	6.2	173.	6.5	175.	6.9	185.	7.2
200.	2.8	200.	2.4	200.	4.6	200.	5.4	200.	3.9	190.	6.7	200.	7.3	200.	7.2
225.	1.0	225.	1.4	207.	4.5	225.	3.2	225.	2.2	200.	5.5	208.	7.2	207.	5.9
250.	1.4	250.	.5	221.	2.4	250.	.3	250.	1.3	225.	4.6	216.	5.7	237.	3.6
275.	.4	275.	-.2	243.	1.3	275.	-2.0	275.	.3	235.	4.8	228.	4.2	260.	2.3
300.	-.9	300.	-.8	267.	.6	300.	-2.3	300.	-.7	250.	3.0	250.	2.8	289.	.8
325.	-2.0	325.	-1.5	287.	-.5	325.	-3.1	325.	-1.7	275.	1.1	275.	1.5	300.	.2
350.	-2.8	350.	-2.1	300.	-1.3			350.	-2.7	300.	0.0	300.	.4	325.	-1.1
		375.	-3.3	325.	-3.0					325.	-1.4	325.	-1.1	350.	-2.0
										350.	-2.4	350.	-2.6	368.	-2.6
										375.	-3.7				

LINE 3

DATE	740204	DATE	740308	DATE	740401	DATE	740530	DATE	740816	DATE	740930	DATE	741205
SRVY	34	SRVY	35	SRVY	36	SRVY	37	SRVY	38	SRVY	39	SRVY	40
112.	13.0	112.	13.3	112.	13.1	112.	13.2	112.	13.3	112.	13.2	112.	13.2
117.	12.9	114.	13.0	117.	12.9	118.	13.0	117.	13.0	116.	13.0	116.	13.1
131.	6.5	125.	6.9	133.	6.4	134.	6.6	128.	7.3	125.	7.3	126.	7.3
153.	6.2	138.	6.2	156.	6.7	159.	7.2	154.	6.8	150.	6.7	138.	6.9
180.	7.2	150.	6.9	163.	7.5	186.	7.5	159.	7.2	157.	7.3	149.	8.9
200.	7.2	173.	7.4	200.	7.2	200.	6.0	186.	7.1	175.	7.5	165.	8.0
212.	5.5	184.	7.0	226.	5.4	225.	3.8	200.	5.6	200.	6.0	190.	6.6
234.	5.4	200.	4.6	250.	2.7	250.	2.5	220.	5.1	225.	4.0	200.	5.7
260.	1.8	225.	4.0	275.	1.5	275.	1.3	245.	2.5	250.	2.3	225.	3.7
300.	.6	250.	2.0	300.	.7	300.	.4	275.	1.3	275.	1.2	250.	2.6
325.	-.2	275.	.3	325.	-.5	325.	.4	300.	.8	300.	.5	275.	1.7
350.	-1.5	300.	-2.7	350.	-2.2	350.	-.5	325.	.1	325.	.1	300.	1.0
375.	-2.8			375.	-3.5	375.	-1.3	350.	-.5	350.	-.2	325.	.5
						400.	-2.8	375.	-1.3	375.	-.7	350.	-.4
								400.	-2.0	400.	-2.4	375.	-2.6
								425.	-2.8				

LINE 4

DATE	701113	DATE	701214	DATE	710114	DATE	710209	DATE	710309	DATE	710408	DATE	710510	DATE	710607
SRVY	2	SRVY	3	SRVY	4	SRVY	5	SRVY	6	SRVY	7	SRVY	8	SRVY	9
191.	10.1	191.	10.0	191.	10.0	191.	10.1	191.	10.0	191.	10.0	191.	9.9	191.	9.9
192.	3.0	192.	5.5	193.	4.6	192.	4.2	193.	3.4	193.	4.0	192.	4.5	192.	4.9
200.	2.4	200.	4.4	200.	3.7	200.	3.6	200.	2.7	200.	3.3	200.	3.4	200.	4.3
225.	1.3	225.	2.4	225.	1.2	225.	1.7	225.	1.0	225.	1.2	225.	1.7	225.	4.6
250.	.8	250.	1.5	250.	.8	250.	.6	250.	.1	250.	.4	250.	1.0	250.	2.0
275.	-.3	275.	.8	275.	1.1	275.	-.1	275.	-.6	275.	.2	275.	0.0	275.	.4
300.	.1	300.	.2	300.	1.0	300.	-.8	300.	-1.1	300.	-.7	300.	-1.2	300.	-1.1
325.	-.5	325.	.1	325.	.5	325.	-1.1	325.	-1.1	325.	-2.0	325.	-2.6	325.	-2.8
350.	-.9	350.	-1.0	350.	-.6	350.	-1.6	350.	-1.3	350.	-3.8			350.	-4.0
375.	-1.6	375.	-2.0	375.	-2.0	375.	-2.0	375.	-2.4						
400.	-2.2	400.	-2.9	400.	-3.0	400.	-1.8	400.	-3.6						
425.	-3.4					425.	-2.6								

LINE 4

DATE 710809		DATE 710831		DATF 711006		DATE 711218		DATE 720103		DATE 720208		DATE 720317		DATE 720413	
SRVY	10	SRVY	11	SRVY	12	SRVY	13	SRVY	14	SRVY	15	SRVY	16	SRVY	17
191.	10.2	191.	10.2	191.	10.1	191.	10.2	191.	10.2	191.	10.1	191.	10.2	191.	10.1
192.	6.1	192.	5.5	192.	3.5	193.	4.1	193.	4.3	192.	4.9	192.	3.7	192.	3.5
200.	4.8	200.	4.8	200.	2.8	200.	3.6	200.	3.5	200.	4.2	200.	2.8	200.	2.6
225.	1.7	225.	2.7	225.	1.2	225.	2.5	225.	2.0	225.	2.5	225.	1.7	225.	1.5
250.	.7	250.	1.4	250.	-.3	250.	1.7	250.	1.1	250.	1.2	250.	.8	250.	.8
275.	.1	275.	.8	275.	-.6	275.	.9	275.	.4	275.	.4	275.	.5	275.	.2
300.	-.3	300.	.2	300.	-.2	300.	.1	300.	-.1	300.	-.2	300.	-.5	300.	-.1
325.	-.9	325.	-.7	325.	-.6	325.	-.5	325.	-.6	325.	-.7	325.	-1.0	325.	-.8
350.	-1.7	350.	-2.1	350.	-1.3	350.	-1.2	350.	-1.1	350.	-1.2	350.	-2.0	350.	-1.7
375.	-2.0	375.	-3.9	375.	-2.2	375.	-2.3	375.	-1.6	375.	-1.6	375.	-1.6	375.	-2.4
				400.	-3.4	400.	-3.7	400.	-2.2	400.	-2.2	400.	-2.0	400.	-2.3
								418.	-2.6	411.	-2.6	425.	-2.5	425.	-2.7
												450.	-3.3	450.	-3.4
												475.	-3.6		

LINE 4

DATE 720609		DATE 720625		DATE 720805		DATE 720929		DATE 721211		DATE 730115		DATE 730215		DATE 730315	
SRVY	18	SRVY	19	SRVY	20	SRVY	21	SRVY	22	SRVY	23	SRVY	24	SRVY	25
191.	10.1	191.	10.2	191.	10.2	191.	10.2	191.	10.0	191.	10.2	191.	10.2	191.	10.2
192.	10.1	192.	5.8	192.	6.8	192.	10.2	194.	5.1	193.	4.1	193.	4.6	192.	4.8
193.	5.0	200.	5.0	200.	5.4	193.	6.9	200.	4.4	200.	3.2	200.	3.8	200.	4.1
200.	4.0	225.	3.1	225.	3.4	207.	6.7	225.	2.5	225.	1.4	225.	2.1	225.	2.2
225.	2.7	250.	1.7	250.	2.0	232.	3.2	250.	1.6	250.	.6	250.	1.0	250.	1.4
250.	2.1	275.	.9	275.	.4	254.	1.8	275.	.7	275.	0.0	275.	.2	275.	.8
275.	1.5	300.	.3	300.	-1.0	279.	.9	300.	0.0	300.	-.3	300.	-.5	300.	.1
300.	.7	325.	-.6	325.	-1.5	300.	.3	325.	-.4	325.	-.6	325.	-1.2	325.	-.4
325.	-.1	350.	-2.1	350.	-1.5	325.	-.4	350.	-1.1	350.	-1.0	350.	-1.4	350.	-1.3
350.	-1.2	375.	-3.1	375.	-1.1	350.	-.8	375.	-1.4	375.	-1.6	375.	-1.9	375.	-1.7
375.	-1.9			400.	-1.5	375.	-1.3	400.	-1.9	400.	-2.4	400.	-2.2	400.	-2.0
400.	-2.4			425.	-2.1	400.	-1.9	425.	-2.4	425.	-3.0	425.	-2.5	425.	-2.6
				450.	-2.8	425.	-2.5	450.	-3.2	450.	-3.5	450.	-3.0		

LINE 4

DATE 730328		DATE 730413		DATE 730614		DATE 730712		DATE 730809		DATE 731008		DATE 731205		DATE 740107	
SRVY	26	SRVY	27	SRVY	28	SRVY	29	SRVY	30	SRVY	31	SRVY	32	SRVY	33
191.	10.2	191.	10.1	191.	10.1	191.	10.2	191.	10.3	191.	10.2	191.	10.2	191.	10.2
192.	10.2	193.	5.1	192.	5.3	192.	6.5	192.	6.7	192.	5.4	192.	6.8	192.	6.1
193.	5.0	200.	2.3	200.	4.8	200.	6.1	200.	6.1	200.	4.6	200.	5.6	200.	4.0
200.	3.7	225.	.7	225.	4.2	225.	4.8	225.	3.7	225.	3.1	225.	3.8	225.	2.6
225.	1.4	250.	-.2	250.	2.4	250.	2.2	250.	2.3	250.	2.2	250.	2.6	250.	1.5
250.	.7	275.	-.2	275.	.5	275.	.5	275.	1.3	275.	1.8	275.	1.7	275.	.9
275.	-.1	300.	-.8	300.	-1.4	300.	-1.1	300.	.2	300.	1.2	300.	.7	300.	.5
300.	-1.1	325.	-.7	325.	-2.7	325.	-2.1	325.	-.7	325.	.4	325.	-.3	325.	-.3
325.	-2.4	350.	-2.0	350.	-3.6	350.	-2.9	350.	-1.7	350.	-.6	350.	-1.1	350.	-1.5
344.	-3.3	375.	-3.1			375.	-3.1	375.	-2.3	375.	-1.8	375.	-1.9	375.	-2.1
		400.	-3.4					400.	-3.0	400.	-3.6	391.	-2.7	400.	-2.7

LINE 4

DATE 740204		DATE 740308		DATE 740401		DATE 740530		DATE 740816		DATE 740930		DATE 741203	
SRVY	34	SRVY	35	SRVY	36	SRVY	37	SRVY	38	SRVY	39	SRVY	40
191.	10.2	191.	10.2	191.	10.4	191.	10.2	191.	10.1	191.	10.1	191.	10.2
193.	5.4	192.	5.0	192.	5.2	193.	4.9	193.	5.2	193.	5.7	192.	10.2
200.	4.7	200.	4.4	200.	4.4	200.	4.2	200.	5.0	200.	4.9	193.	4.5
225.	2.6	225.	2.7	225.	2.6	225.	2.7	225.	3.3	225.	3.1	200.	3.6
250.	1.5	250.	1.3	250.	1.4	250.	1.6	250.	1.9	250.	1.8	225.	1.9
275.	.7	275.	.5	275.	.7	275.	1.1	275.	1.2	275.	1.1	250.	1.3
300.	.1	300.	-.2	300.	.2	300.	.6	300.	.6	300.	.5	275.	.7
325.	-.5	325.	-.5	325.	-.2	325.	.1	325.	.1	325.	.1	300.	.2
350.	-1.1	350.	-.7	350.	-.7	350.	.1	350.	-.5	350.	-.4	325.	-.4
375.	-1.6	375.	-1.3	375.	-1.5	375.	-.3	375.	-.9	375.	-1.0	350.	-1.2
400.	-2.0	400.	-1.8	400.	-1.9	400.	-.8	400.	-1.3	400.	-1.5	375.	-2.1
425.	-2.4	425.	-2.5	425.	-3.0	425.	-1.5	425.	-1.8	425.	-2.1	400.	-2.7
450.	-3.0					450.	-2.2	450.	-2.4	450.	-2.6		
						475.	-2.9	475.	-2.8				

LINE 5

DATE 701113		DATE 701214		DATE 710114		DATE 710209		DATE 710309		DATE 710408		DATE 710510		DATE 710607	
SRVY	2	SRVY	3	SRVY	4	SRVY	5	SRVY	6	SRVY	7	SRVY	8	SRVY	9
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187.	15.1	187.	15.2	187.	15.2	187.	15.1	187.	15.0	187.	15.1	187.	15.2	187.	15.4
200.	15.4	200.	15.2	200.	15.3	200.	15.2	200.	15.1	199.	15.1	196.	15.2	196.	15.1
218.	5.0	215.	6.4	206.	10.6	210.	7.3	216.	5.6	209.	5.8	200.	10.2	205.	7.5
241.	3.2	223.	5.2	214.	5.6	225.	4.9	225.	4.5	225.	4.2	211.	5.3	210.	5.6
261.	2.1	243.	4.9	225.	4.7	250.	3.1	250.	2.6	250.	2.5	225.	4.1	225.	4.6
285.	1.4	270.	2.8	250.	3.8	275.	1.7	275.	1.3	275.	1.4	250.	2.5	250.	4.4
300.	.9	290.	2.1	275.	1.8	300.	.7	300.	.4	300.	.6	275.	1.3	275.	4.9
325.	.4	300.	1.8	300.	1.1	325.	0.0	325.	-.3	325.	0.0	300.	.6	300.	1.3
350.	-.4	325.	1.1	325.	.6	350.	-.5	350.	-.9	350.	-.4	325.	0.0	325.	0.0
375.	-.4	350.	.4	350.	1.2	375.	-1.1	375.	-1.4	375.	-.4	350.	-.2	350.	-.8
400.	-.9	375.	.1	375.	.6	400.	-1.5	400.	-1.7	400.	-.8	375.	-.5	375.	-2.0
425.	-1.4	400.	-.5	400.	-.3	425.	-2.0	425.	-1.8	425.	-2.1	400.	-.9	400.	-3.1
450.	-1.8	425.	-1.6	425.	-1.6	450.	-2.5	450.	-3.3	445.	-3.3	425.	-2.0		
475.	-2.7	450.	-2.8	450.	-2.8							450.	-2.8		

LINE 5

DATE 710809		DATE 710831		DATE 711006		DATE 711214		DATE 720103		DATE 720208		DATE 720317		DATE 720413	
SRVY	10	SRVY	11	SRVY	12	SRVY	13	SRVY	14	SRVY	15	SRVY	16	SRVY	17
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187.	15.3	187.	15.7	187.	15.4	187.	15.5	187.	15.6	187.	15.6	187.	16.0	187.	16.2
194.	14.9	195.	15.1	195.	15.2	194.	15.6	194.	15.5	194.	15.4	192.	15.7	193.	15.6
200.	10.1	215.	5.5	213.	6.3	200.	10.4	200.	10.4	200.	10.6	212.	6.1	210.	6.2
213.	5.3	240.	6.1	225.	6.6	208.	6.6	208.	6.5	210.	6.3	236.	3.5	238.	3.5
218.	5.8	260.	6.2	236.	6.9	233.	5.9	232.	3.9	225.	5.2	269.	1.2	267.	2.1
253.	6.1	285.	3.9	238.	6.2	258.	2.9	257.	2.2	250.	3.2	287.	1.2	282.	1.4
264.	5.3	300.	3.1	250.	4.5	283.	1.8	282.	1.2	275.	2.0	300.	.7	287.	1.3
289.	4.3	325.	1.3	275.	2.7	300.	1.2	300.	.6	300.	1.0	325.	0.0	300.	.8
300.	3.0	350.	-.1	300.	1.1	325.	.5	325.	.1	325.	.3	350.	-.7	325.	.1
325.	.5	375.	-1.4	325.	1.0	350.	-.1	350.	-.3	350.	-.2	375.	-.2	350.	-.5
350.	-.6	400.	-3.0	350.	.4	375.	-.7	375.	-.7	375.	-.6	400.	-1.0	375.	-1.0
375.	-2.3			375.	-.4	400.	-1.1	400.	-1.2	400.	-1.3	425.	-1.6	400.	-1.0
400.	-3.1			400.	-1.2	425.	-2.0	425.	-1.7	425.	-1.9	450.	-2.1	425.	-2.0
				425.	-2.4	450.	-3.1	450.	-2.5	445.	-2.8	475.	-2.9	450.	-2.0
												500.	-3.7	475.	-2.5
														500.	-3.4

LINE 5

DATE 720609		DATE 720625		DATE 720805		DATE 720929		DATE 721211		DATE 730115		DATE 730215		DATE 730315	
SRVY	18	SRVY	19	SRVY	20	SRVY	21	SRVY	22	SRVY	23	SRVY	24	SRVY	25
187.	16.2	187.	16.2	187.	16.4	187.	16.4	187.	16.3	187.	16.7	187.	16.6	187.	16.3
192.	16.0	193.	16.0	192.	16.0	192.	15.9	192.	15.9	192.	16.0	192.	16.0	192.	15.9
202.	6.9	204.	6.6	207.	6.4	200.	9.0	204.	7.9	200.	9.2	206.	6.8	206.	6.8
229.	4.2	225.	3.9	233.	5.1	208.	6.4	225.	5.4	225.	5.2	231.	4.5	233.	5.1
257.	1.9	250.	2.3	256.	4.5	228.	6.4	250.	3.3	250.	3.3	256.	2.9	254.	4.5
287.	.8	275.	1.1	277.	2.6	231.	5.5	275.	1.9	275.	1.4	278.	2.3	283.	2.8
300.	.7	300.	.4	300.	.7	255.	3.1	300.	.9	300.	1.4	300.	1.5	300.	1.5
325.	.6	325.	-.1	325.	-1.2	278.	1.8	325.	.4	325.	.9	325.	.7	325.	.9
350.	.3	350.	-.5	350.	-1.6	300.	1.1	350.	-.2	350.	1.1	350.	.2	350.	.3
375.	0.0	375.	-1.2	375.	-1.2	325.	.7	375.	-.6	375.	-.6	375.	0.0	375.	-.5
400.	-.5	400.	-2.5	400.	-1.6	350.	0.0	400.	-1.1	400.	-1.2	400.	-.2	400.	-1.3
425.	-1.4	425.	-2.5	425.	-2.1	375.	-.6	425.	-1.8	425.	-1.9	425.	-1.1	425.	-2.2
450.	-2.3	450.	-2.6	450.	-2.7	400.	-1.5	450.	-2.9	450.	-2.6	450.	-2.0	450.	-3.0
475.	-2.6					425.	-2.3					475.	-2.8		
						450.	-3.0								

LINE 5

DATE 730320		DATE 730413		DATE 730614		DATE 730712		DATE 730809		DATE 731008		DATE 731205		DATE 740107	
SRVY	26	SRVY	27	SRVY	28	SRVY	29	SRVY	30	SRVY	31	SRVY	32	SRVY	33
187.	16.3	187.	16.5	187.	16.6	187.	16.4	187.	16.4	187.	16.4	187.	16.6	187.	16.3
191.	16.0	192.	16.0	190.	16.4	190.	16.4	208.	6.9	190.	16.3	204.	7.6	202.	7.8
202.	7.9	208.	7.0	211.	6.9	210.	6.6	225.	6.2	209.	7.5	225.	6.8	230.	5.9
225.	5.3	232.	4.3	236.	5.6	225.	6.1	250.	3.8	225.	6.6	250.	4.9	250.	4.1
250.	3.6	250.	2.8	261.	3.1	250.	5.2	275.	2.3	233.	6.7	275.	3.5	275.	2.4
275.	2.1	275.	1.6	286.	1.8	275.	4.2	300.	1.0	250.	4.7	300.	2.4	300.	.3
300.	1.1	300.	.7	300.	.9	300.	2.4	325.	.5	275.	2.9	325.	1.3	325.	.3
325.	.4	325.	.3	325.	.1	325.	.1	350.	-.1	300.	1.6	350.	.6	350.	-.5
350.	-.1	350.	-.3	350.	-.7	350.	-1.8	375.	-1.2	325.	1.3	375.	-.5	375.	-1.0
375.	-.6	375.	-.5	375.	-1.2	375.	-1.9	400.	-2.2	350.	1.0	400.	-1.6	400.	-1.6
400.	-.8	400.	-1.7	400.	-1.6	400.	-3.3	425.	-4.2	375.	0.0	425.	-3.0	425.	-2.1
425.	-1.2	425.	-2.6	425.	-2.9					400.	-1.2			450.	-2.9
450.	-1.8									425.	-2.3				
475.	-2.2									450.	-4.6				
490.	-2.4														

LINE 5

DATE	740204
SRVY	34
187.	16.8
191.	10.4
205.	7.8
219.	7.0
250.	4.1
275.	2.0
300.	1.1
325.	.3
350.	-.5
375.	-1.0
400.	-1.4
425.	-1.7
450.	-2.0
475.	-2.8

DATE	740308
SRVY	35
187.	16.1
210.	6.8
225.	4.9
250.	2.9
275.	1.8
300.	.8
325.	0.0
350.	-.5
375.	-.9
400.	-1.8
425.	-2.0
450.	-2.6

DATE	740401
SRVY	36
187.	16.4
200.	8.4
217.	5.6
247.	3.1
273.	1.7
300.	.7
325.	0.0
350.	-.5
375.	-1.1
400.	-1.5
425.	-1.1
450.	-2.1
475.	-2.7

DATE	740530
SRVY	37
187.	16.3
218.	6.1
239.	4.1
264.	2.3
285.	1.4
300.	1.1
325.	.5
350.	-.1
375.	-.7
400.	-1.3
425.	-1.6
450.	-1.6
475.	-2.7

DATE	740816
SRVY	38
187.	16.3
193.	15.1
214.	6.0
239.	4.6
260.	3.3
286.	1.9
300.	1.6
325.	1.4
350.	1.1
375.	.3
400.	-.4
425.	-1.4
450.	-2.4

DATE	740930
SRVY	39
187.	15.9
200.	9.3
214.	6.2
225.	5.8
250.	4.8
275.	3.6
300.	2.2
325.	1.5
350.	.7
375.	.1
400.	.2
425.	-.7
450.	-2.4

DATE	741203
SRVY	40
187.	16.4
200.	7.3
218.	4.9
240.	3.5
260.	2.1
285.	1.5
300.	1.1
325.	.5
350.	-.2
375.	-1.2
400.	-1.7
425.	-2.0
450.	-1.6
475.	-1.7
500.	-2.1

LINE 6

DATE	701113
SRVY	2
188.	15.5
200.	12.9
207.	11.5
224.	10.8
227.	6.6
253.	3.2
275.	2.2
300.	1.5
325.	.6
350.	-.6
375.	-.4
400.	-.2
425.	-.6
450.	-1.3
475.	-2.0
500.	-2.9

DATE	701214
SRVY	3
188.	15.9
200.	12.2
223.	10.7
226.	6.7
250.	4.9
275.	3.2
300.	2.2
325.	1.5
350.	.8
375.	.3
400.	-.1
425.	-1.1
450.	-2.5

DATE	710114
SRVY	4
188.	15.5
206.	11.5
221.	10.7
227.	5.7
250.	4.2
275.	2.9
300.	1.3
325.	1.1
350.	1.1
375.	.8
400.	.2
425.	-1.0
450.	-2.3
475.	-3.2

DATE	710209
SRVY	5
188.	15.6
200.	12.3
222.	10.6
227.	6.4
250.	4.0
275.	2.3
300.	1.2
325.	.4
350.	-.2
375.	-.8
400.	-1.3
425.	-1.6
450.	-1.8
475.	-2.2
500.	-2.7

DATE	710309
SRVY	6
188.	15.6
194.	14.6
200.	12.3
221.	10.7
228.	6.0
250.	3.3
275.	1.7
300.	.6
325.	.3
350.	.6
375.	.4
400.	-.4
425.	-2.0
450.	-3.4

DATE	710408
SRVY	7
188.	15.4
200.	12.2
218.	10.8
224.	6.3
250.	4.5
275.	3.8
300.	2.7
325.	1.0
350.	-.2
375.	-2.0
390.	-3.8

DATE	710510
SRVY	8
188.	15.5
197.	13.6
200.	12.3
219.	10.6
221.	7.2
229.	6.4
250.	6.2
275.	3.2
300.	1.6
325.	.5
350.	-.6
375.	-1.7
400.	-2.5

DATE	710607
SRVY	9
188.	15.5
200.	12.4
218.	10.6
221.	7.2
225.	6.4
250.	6.2
265.	4.6
275.	4.7
290.	4.7
300.	3.5
325.	1.2
350.	-.2
375.	-1.8
400.	-4.4

LINE 6

DATE	710809	DATE	710831	DATE	711006	DATE	711214	DATE	720103	DATE	720208	DATE	720317	DATE	720413
SRVY	10	SRVY	11	SRVY	12	SRVY	13	SRVY	14	SRVY	15	SRVY	16	SRVY	17
188.	15.5	188.	15.3	188.	15.4	188.	15.6	188.	15.6	188.	15.4	188.	15.7	188.	15.7
194.	14.6	200.	12.4	200.	12.5	200.	12.7	200.	12.4	200.	12.4	200.	12.6	200.	12.5
200.	12.4	216.	10.3	219.	10.8	218.	11.1	216.	10.9	215.	11.0	216.	11.9	219.	10.9
219.	10.8	224.	7.1	225.	7.9	222.	8.2	222.	8.2	224.	7.8	226.	7.5	223.	8.4
221.	7.4	249.	6.4	250.	7.0	250.	4.8	247.	5.3	250.	5.0	252.	4.6	249.	4.8
247.	6.3	258.	6.1	252.	5.9	275.	3.3	272.	3.1	275.	3.4	277.	2.6	275.	2.5
260.	6.2	283.	3.2	275.	3.4	300.	2.3	300.	1.8	300.	2.4	300.	1.6	300.	1.5
269.	5.5	300.	2.7	300.	2.1	325.	1.5	325.	1.0	325.	1.4	325.	1.0	325.	.8
295.	3.1	325.	1.4	325.	.8	350.	.8	350.	.2	350.	.6	350.	0.0	350.	0.0
300.	2.8	350.	.5	350.	.5	375.	.1	375.	-.2	375.	-.1	375.	-.6	375.	-.9
325.	1.9	375.	-.3	375.	0.0	400.	-.5	400.	-.5	400.	-.8	400.	-1.0	400.	-1.1
350.	.7	400.	-1.2	400.	-.7	425.	-.8	425.	-.9	425.	-1.7	425.	-1.4	425.	-1.3
375.	-.5	425.	-2.5	425.	-1.6	450.	-2.2	450.	-1.7	450.	-2.7	450.	-1.9	450.	-1.7
400.	-1.9			450.	-3.7	475.	-3.3	475.	-2.8			475.	-2.1	475.	-2.2
425.	-2.3											500.	-3.0	500.	-2.7

LINE 6

DATE	720609	DATE	720625	DATE	720805	DATE	720929	DATE	721211	DATE	730115	DATE	730215	DATE	730315
SRVY	18	SRVY	19	SRVY	20	SRVY	21	SRVY	22	SRVY	23	SRVY	24	SRVY	25
188.	15.5	188.	15.6	188.	15.6	188.	15.8	188.	15.8	188.	15.7	188.	15.7	188.	15.7
200.	12.5	195.	16.3	200.	12.6	200.	12.6	200.	13.0	195.	14.5	200.	12.6	200.	12.6
211.	12.2	200.	12.5	206.	11.8	205.	11.7	218.	11.5	200.	12.9	205.	12.0	210.	12.6
223.	8.4	205.	11.6	217.	10.6	218.	10.6	225.	8.0	212.	12.7	211.	12.7	217.	10.5
249.	4.9	210.	10.6	229.	7.2	222.	8.8	250.	4.8	237.	5.7	225.	10.3	225.	7.1
275.	3.7	222.	8.3	250.	5.1	236.	6.3	275.	3.0	262.	4.1	250.	4.2	250.	4.6
300.	1.4	250.	4.8	275.	3.1	259.	6.0	300.	1.5	293.	1.7	275.	2.4	275.	2.9
325.	1.0	275.	2.9	300.	1.8	282.	3.3	325.	.8	300.	1.0	300.	1.3	300.	1.7
350.	1.3	300.	1.5	325.	.8	300.	2.2	350.	.2	325.	.3	325.	.4	325.	.9
375.	1.0	325.	.6	350.	-.5	325.	1.0	375.	-.3	350.	.9	350.	-.2	350.	.3
400.	.3	350.	0.0	375.	-2.1	350.	.5	400.	-.9	375.	.1	375.	-.7	375.	-.1
425.	-.4	375.	-.4	400.	-2.7	375.	0.0	425.	-1.5	400.	-.5	400.	-.9	400.	-.6
450.	-1.3	400.	-1.0	425.	-2.2	400.	-.3	450.	-2.0	425.	-2.2	425.	-1.0	425.	-1.1
475.	-2.4	425.	-2.2	450.	-2.1	425.	-.9	475.	-2.4	450.	-2.8	450.	-1.1	450.	-1.6
500.	-3.1	450.	-2.3	475.	-2.4	450.	-1.7					475.	-1.6	475.	-2.3
		475.	-1.9	500.	-2.9	475.	-2.6					500.	-2.5	500.	-2.8
		500.	-2.5												

LINE 6

DATE 730328
SRVY 26

188.	15.8
194.	14.9
200.	12.7
213.	12.1
224.	7.8
250.	4.7
275.	2.8
300.	1.5
325.	.8
350.	.2
375.	-.9
400.	-1.8
425.	-2.7

DATE 730413
SRVY 27

188.	15.8
195.	14.8
200.	12.9
211.	12.7
219.	10.3
222.	7.8
240.	4.3
275.	1.9
300.	.8
325.	.1
350.	-.8
375.	-1.0
400.	-1.8
425.	-2.7

DATE 730614
SRVY 28

188.	15.8
200.	12.8
210.	12.5
225.	6.7
250.	4.5
275.	3.3
300.	2.3
325.	1.3
350.	.5
375.	-.6
400.	-1.6
425.	-2.2
450.	-2.5

DATE 730712
SRVY 29

188.	15.8
200.	12.8
209.	12.5
225.	7.1
250.	5.8
272.	6.2
288.	3.6
300.	2.5
325.	.9
350.	-1.0
375.	-1.9
400.	-3.1

DATE 730809
SRVY 30

188.	15.8
192.	15.5
200.	12.8
209.	12.5
225.	7.0
250.	6.1
259.	6.1
275.	3.9
300.	2.0
325.	1.1
350.	.6
375.	-.2
400.	-1.4
425.	-2.3

DATE 731008
SRVY 31

188.	15.9
200.	12.9
211.	12.8
216.	10.3
221.	8.1
246.	6.4
267.	4.8
300.	2.9
325.	1.8
350.	.9
375.	.1
400.	.4
425.	-.4
450.	-1.6
475.	-2.4
500.	-4.1

DATE 731205
SRVY 32

188.	15.9
195.	13.3
200.	12.3
207.	12.5
220.	8.1
245.	6.1
275.	4.7
300.	3.6
325.	2.4
350.	1.0
375.	-.5
400.	-2.0
425.	-3.3

DATE 740107
SRVY 33

188.	15.9
200.	12.3
209.	12.2
223.	7.8
250.	6.4
275.	4.1
300.	2.1
325.	1.0
350.	.4
375.	-.7
400.	-1.2
425.	-1.7
450.	-2.4
475.	-3.0

LINE 6

DATE 740204
SRVY 34

188.	16.0
200.	12.8
210.	12.8
218.	10.3
223.	8.3
243.	6.8
268.	4.2
300.	2.2
325.	1.2
350.	.4
375.	-.2
400.	-.7
425.	-2.9
450.	-2.7

DATE 740304
SRVY 35

188.	15.8
200.	12.9
210.	12.6
219.	10.5
225.	8.3
250.	5.1
275.	3.1
300.	1.5
325.	0.0
350.	0.0
375.	.1
400.	-.4
425.	-1.1
450.	-1.7
475.	-2.7

DATE 740401
SRVY 36

188.	15.9
200.	13.1
205.	12.2
211.	12.8
219.	9.8
246.	5.4
261.	4.4
286.	3.0
300.	2.4
325.	.9
350.	.7
375.	.1
400.	-1.1
425.	-2.8

DATE 740530
SRVY 37

188.	15.6
198.	14.9
215.	12.8
233.	7.9
255.	5.1
280.	3.1
300.	1.9
325.	1.1
350.	.3
375.	-.4
400.	-1.0
425.	-1.9
450.	-2.9

DATE 740816
SRVY 38

188.	15.9
205.	12.3
210.	13.1
227.	7.8
246.	5.3
266.	4.6
300.	2.0
325.	1.4
350.	.9
375.	-.1
400.	-.5
425.	-1.3
450.	-2.0
475.	-2.8

DATE 740930
SRVY 39

188.	15.8
196.	14.6
200.	13.1
210.	13.0
228.	7.9
250.	5.5
275.	3.8
300.	2.3
325.	1.5
350.	.7
375.	.1
400.	-.1
425.	0.0
450.	-.8
475.	-2.3

DATE 741203
SRVY 40

188.	15.6
200.	12.3
207.	13.1
222.	9.0
242.	5.1
264.	3.1
290.	1.6
300.	1.5
325.	.8
350.	.1
375.	-1.1
400.	-1.9
425.	-1.7
450.	-1.0
475.	-1.6
500.	-2.7

LINE 7

DATE 701113 SRVY 2		DATE 701218 SRVY 3		DATE 710118 SRVY 4		DATE 710209 SRVY 5		DATE 710309 SRVY 6		DATE 710408 SRVY 7		DATE 710510 SRVY 8		DATE 710607 SRVY 9	
173.	14.3	173.	14.2	173.	14.8	173.	14.3	173.	14.3	173.	14.2	173.	14.1	173.	14.2
203.	14.8	203.	14.8	205.	14.9	200.	14.6	185.	14.8	181.	14.5	195.	13.8	194.	13.7
210.	11.7	214.	11.5	213.	12.0	203.	15.1	195.	14.0	193.	13.9	200.	14.2	200.	14.4
227.	11.1	228.	11.1	227.	11.2	216.	11.3	200.	14.5	204.	14.8	205.	15.0	205.	14.9
230.	6.6	230.	7.0	232.	6.1	227.	11.2	204.	15.1	218.	11.8	215.	11.6	215.	11.4
255.	3.6	244.	4.8	259.	4.1	232.	6.0	214.	11.8	225.	11.5	225.	11.0	226.	10.9
275.	2.1	276.	5.6	275.	3.5	250.	4.4	225.	11.6	229.	6.4	228.	6.7	229.	6.6
300.	1.2	300.	2.6	300.	3.5	275.	3.1	240.	5.3	250.	4.6	250.	6.4	250.	6.4
325.	-.1	325.	1.5	325.	3.1	300.	1.8	250.	4.3	275.	3.0	275.	5.5	275.	4.8
350.	.2	350.	.8	350.	1.9	325.	.7	275.	2.6	300.	2.3	300.	2.2	300.	3.0
375.	.2	375.	0.0	375.	.8	350.	-.1	300.	1.1	325.	1.4	325.	.4	325.	1.1
400.	-.3	400.	-1.0	400.	-.6	375.	-.6	325.	.2	350.	.2	350.	-.9	350.	0.0
425.	-.8	425.	-2.5	425.	-2.2	400.	-1.2	350.	-.4	375.	-1.1	375.	-1.6	375.	-1.1
450.	-2.0			450.	-3.2	425.	-1.8	375.	-1.0	392.	-3.7	400.	-1.9	400.	-2.1
475.	-3.5					450.	-2.1	400.	-1.4			425.	-1.4	415.	-2.5
						475.	-2.4	425.	-2.1						
								450.	-3.5						

LINE 7

DATE 710809 SRVY 10		DATE 710831 SRVY 11		DATE 711006 SRVY 12		DATE 711214 SRVY 13		DATE 720103 SRVY 14		DATE 720208 SRVY 15		DATE 720317 SRVY 16		DATE 720413 SRVY 17	
173.	14.1	173.	14.2	173.	14.1	173.	14.2	173.	14.2	173.	14.2	173.	14.3	173.	14.2
193.	13.8	188.	14.5	200.	14.3	195.	13.9	194.	13.8	200.	14.3	201.	14.7	200.	14.2
204.	14.9	194.	13.9	205.	14.6	204.	15.1	205.	15.0	205.	14.8	212.	12.0	204.	14.8
210.	11.5	202.	14.9	215.	11.7	213.	11.9	214.	11.7	224.	10.9	223.	11.6	215.	11.7
225.	11.1	217.	10.9	225.	11.1	224.	11.8	225.	11.0	229.	7.8	228.	8.2	224.	11.2
229.	7.1	224.	10.8	230.	7.8	228.	7.7	229.	7.7	250.	6.0	253.	5.9	228.	8.6
254.	6.4	227.	7.2	250.	7.0	253.	4.6	254.	5.7	275.	5.1	277.	3.2	250.	5.8
278.	5.4	252.	6.6	251.	4.1	278.	3.7	279.	3.6	300.	3.7	300.	1.9	275.	2.9
300.	2.5	281.	3.8	275.	3.3	300.	3.1	300.	2.3	325.	2.0	325.	1.0	300.	1.5
325.	1.4	300.	2.9	300.	2.2	325.	2.3	325.	1.4	350.	.7	350.	.1	325.	.8
350.	.8	325.	1.6	325.	1.3	350.	1.2	350.	.7	375.	-.1	375.	-1.1	350.	.1
375.	-.1	350.	.9	350.	.2	375.	.5	375.	.1	400.	-.8	400.	-1.0	375.	-.7
400.	-1.3	375.	-.3	375.	-.4	400.	.1	400.	-.3	425.	-1.6	425.	-1.4	400.	-1.4
425.	-2.5	400.	-1.7	400.	-1.3	425.	-.8	425.	-.9	450.	-2.6	450.	-1.6	425.	-1.7
		425.	-3.2	425.	-2.5	450.	-2.5	450.	-2.0			475.	-2.5	450.	-1.6
				450.	-3.4			475.	-3.2					475.	-2.1
														500.	-2.6
														525.	-3.2

LINE 7

DATE	720609	DATE	720629	DATE	720805	DATE	720929	DATE	721211	DATE	730115	DATE	730215	DATE	730315
SRVY	18	SRVY	19	SRVY	20	SRVY	21	SRVY	22	SRVY	23	SRVY	24	SRVY	25
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173.	14.3	173.	14.3	173.	14.3	173.	14.3	173.	14.5	173.	14.7	173.	14.7	173.	14.7
198.	14.4	194.	13.9	194.	13.8	187.	14.6	200.	14.8	183.	15.3	193.	14.2	187.	15.2
205.	15.0	200.	14.9	200.	14.7	200.	14.3	214.	12.1	200.	15.0	200.	14.6	195.	14.4
224.	11.2	216.	11.4	204.	15.1	205.	15.0	223.	11.8	205.	15.4	207.	15.5	200.	15.1
230.	6.4	224.	11.1	215.	11.8	215.	11.9	230.	9.0	215.	12.0	218.	12.1	202.	15.4
250.	6.2	227.	9.9	225.	11.7	225.	11.5	255.	6.2	224.	11.7	225.	12.1	214.	11.9
275.	4.2	246.	6.6	232.	8.1	228.	9.3	280.	3.9	249.	6.2	242.	7.8	220.	11.8
300.	1.9	274.	3.5	254.	6.2	236.	7.6	300.	2.4	274.	3.8	261.	4.8	225.	9.6
325.	.6	300.	1.8	277.	4.4	254.	6.5	325.	1.3	300.	2.2	287.	2.9	250.	5.7
350.	.5	325.	.7	300.	3.5	279.	6.6	350.	.5	325.	1.6	300.	2.1	275.	3.3
375.	.2	350.	0.0	325.	1.6	300.	3.8	375.	-.1	350.	.6	325.	1.2	300.	1.9
400.	-.1	375.	-.6	350.	-.5	325.	1.7	400.	-.5	375.	.1	350.	.5	325.	1.3
425.	-.5	400.	-.7	376.	-2.2	350.	.7	425.	-.6	400.	-.5	375.	-.2	350.	.7
450.	-1.5	425.	-1.5	400.	-2.7	375.	-.1	450.	-1.4	425.	-1.1	400.	-.7	375.	.2
475.	-2.1	450.	-2.8	425.	-3.3	400.	-.8	475.	-1.6	450.	-1.5	425.	-1.2	400.	-.5
500.	-2.6	475.	-3.2	450.	-3.2	425.	-1.6	500.	-3.1	475.	-2.1	450.	-1.5	425.	-1.2
		500.	-2.5	488.	-2.2	450.	-2.6			500.	-2.8	475.	-1.6	450.	-1.8
		525.	-3.0	500.	-2.0							500.	-1.9	475.	-2.6
				525.	-2.2							525.	-2.5		
				550.	-2.7										

LINE 7

DATE	730328	DATE	730613	DATE	730614	DATE	730712	DATE	730809	DATE	731008	DATE	731205	DATE	740107
SRVY	26	SRVY	27	SRVY	28	SRVY	29	SRVY	30	SRVY	31	SRVY	32	SRVY	33
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173.	14.2	173.	14.7	173.	14.7	173.	14.8	173.	14.7	173.	14.7	173.	14.7	173.	14.7
195.	14.0	200.	14.8	196.	14.4	200.	15.0	195.	14.5	193.	14.4	190.	14.4	200.	14.9
205.	15.1	205.	15.3	204.	15.6	208.	15.3	200.	15.0	205.	15.2	200.	15.4	208.	13.3
218.	12.0	214.	12.3	212.	12.8	226.	12.3	203.	15.6	211.	13.5	207.	13.4	218.	11.3
224.	11.9	225.	11.5	222.	12.7	246.	6.3	213.	13.1	222.	12.5	226.	8.9	232.	8.0
229.	9.0	239.	6.9	240.	6.8	275.	6.3	221.	12.9	227.	9.6	250.	6.1	250.	5.7
254.	5.3	275.	2.9	269.	4.6	300.	4.3	237.	7.3	250.	5.9	275.	4.7	275.	2.8
278.	3.5	300.	1.6	300.	3.6	325.	2.7	253.	6.3	275.	4.2	300.	3.5	300.	1.8
300.	1.8	325.	.8	325.	2.5	350.	1.1	275.	5.2	300.	2.6	325.	2.0	325.	.9
325.	.7	350.	.3	350.	1.0	375.	-.2	300.	3.0	325.	1.5	350.	1.1	350.	.2
350.	-.4	375.	0.0	375.	-.6	400.	-1.6	325.	1.4	350.	1.2	375.	-.6	375.	-.5
375.	-1.1	400.	-.8	400.	-1.7	425.	-2.2	350.	.8	375.	1.4	400.	-1.8	400.	-1.2
400.	-2.4	425.	-1.8	425.	-2.0	450.	-2.1	375.	-.2	400.	-.6	425.	-2.6	425.	-1.8
414.	-2.5	450.	-2.6	450.	-2.1	475.	-2.7	400.	-1.5	425.	-.9			450.	-2.2
				475.	-2.4			425.	-3.0	500.	-2.7			475.	-2.3
				500.	-2.6			450.	-3.3					500.	-2.8

LINE 7

DATE 740204		DATE 740304		DATE 740401		DATE 740530		DATE 740816		DATE 740930		DATE 741204	
SRVY	34	SRVY	35	SRVY	36	SRVY	37	SRVY	38	SRVY	39	SRVY	40
173.	14.8	173.	14.8	173.	14.6	173.	14.7	173.	14.2	173.	14.3	173.	14.3
200.	14.9	200.	15.1	187.	15.4	200.	14.9	195.	14.2	200.	14.5	200.	14.4
205.	15.5	213.	13.1	196.	14.5	208.	15.3	200.	14.6	208.	14.6	208.	14.9
211.	13.2	222.	13.2	200.	14.9	214.	13.4	203.	14.9	214.	12.8	216.	13.0
215.	13.9	229.	9.5	204.	15.5	223.	13.2	210.	13.1	223.	12.7	226.	12.2
221.	12.4	232.	6.9	215.	12.8	236.	7.6	221.	11.7	237.	7.1	235.	7.1
239.	9.6	250.	5.3	220.	13.6	261.	5.1	234.	7.0	250.	6.5	250.	5.2
250.	4.0	275.	3.5	241.	6.0	266.	3.4	259.	5.3	275.	4.6	275.	3.2
285.	2.8	300.	2.0	266.	4.1	300.	2.8	275.	4.6	300.	2.9	300.	1.7
300.	2.1	325.	1.2	300.	2.8	325.	1.9	300.	2.7	325.	1.7	325.	1.0
325.	1.3	350.	1.0	325.	1.5	350.	1.3	325.	1.5	350.	1.0	350.	.4
350.	.5	375.	.5	350.	.8	375.	.6	350.	.7	375.	.3	375.	-.2
375.	-.1	400.	-.2	375.	.1	400.	-.1	375.	.1	400.	-.2	400.	-1.1
400.	-.7	425.	-1.3	400.	-.4	425.	-.8	400.	-.4	425.	0.0	425.	-1.7
425.	-.4	450.	-2.1	425.	-2.2	450.	-1.4	425.	-1.2	450.	-.8	450.	-2.3
450.	-2.0	475.	-2.7	450.	-1.9	475.	-2.7	450.	-1.8	475.	-1.9		
475.	-2.6			475.	-2.2			475.	-2.5	500.	-2.9		
				500.	-2.8			500.	-3.2				

LINE 8

DATE 701113		DATE 701214		DATE 710114		DATE 710209		DATE 710309		DATE 710408		DATE 710510		DATE 710607	
SRVY	2	SRVY	3	SRVY	4	SRVY	5	SRVY	6	SRVY	7	SRVY	8	SRVY	9
172.	18.1	172.	18.0	172.	18.1	172.	18.1	172.	18.1	172.	18.0	172.	18.0	172.	17.9
190.	16.0	190.	15.8	200.	12.7	192.	15.6	175.	18.1	191.	15.8	190.	15.9	190.	15.9
201.	12.6	203.	12.6	228.	7.8	200.	12.9	190.	15.7	202.	12.4	200.	12.7	200.	12.7
213.	11.2	216.	11.0	232.	5.7	225.	8.5	200.	13.0	220.	10.0	219.	10.3	219.	10.2
225.	7.9	233.	7.3	250.	4.3	228.	7.8	217.	11.2	225.	6.1	224.	6.7	223.	6.9
250.	5.0	252.	5.1	275.	3.2	235.	5.8	225.	8.4	250.	3.6	250.	4.1	250.	4.7
275.	3.1	283.	6.0	300.	2.8	250.	4.6	229.	7.6	275.	1.9	275.	2.5	260.	3.9
300.	2.0	300.	3.2	325.	2.2	275.	3.1	250.	4.4	300.	.8	300.	1.4	275.	4.5
325.	1.3	325.	1.5	350.	1.6	300.	1.9	275.	2.5	325.	0.0	325.	.7	293.	4.7
350.	.7	350.	.8	375.	.4	325.	1.0	300.	1.1	350.	-.7	350.	.1	300.	3.7
375.	0.0	375.	-.2	400.	-.9	350.	.3	325.	.3	375.	-1.0	375.	.3	325.	1.3
400.	-.6	400.	-1.4	425.	-2.3	375.	-.3	350.	-.2	400.	-2.2	400.	-.4	350.	-.3
425.	-1.5	425.	-2.6			400.	-.7	375.	-1.0			425.	-.9	375.	-1.9
450.	-2.8					425.	-1.1	400.	-1.7			450.	-1.8	400.	-1.8
						450.	-1.7	425.	-3.3			475.	-2.6	425.	-2.6
						475.	-3.0								

LINE 8

DATE	710809	DATE	710831	DATE	711006	DATE	711218	DATE	720103	DATE	720208	DATE	720317	DATE	720413
SRVY	10	SRVY	11	SRVY	12	SRVY	13	SRVY	14	SRVY	15	SRVY	16	SRVY	17
172.	17.7	172.	18.0	172.	17.6	172.	17.8	172.	17.8	172.	17.7	172.	17.6	172.	18.8
192.	15.3	169.	16.3	189.	16.3	190.	15.7	191.	15.7	190.	15.7	190.	16.1	190.	16.0
200.	12.8	203.	12.6	200.	12.9	200.	12.8	214.	11.8	200.	12.8	200.	12.9	200.	12.9
220.	10.2	219.	10.7	222.	9.4	216.	10.9	220.	9.7	219.	10.1	216.	11.2	220.	10.1
225.	6.5	225.	6.6	225.	6.9	224.	6.5	223.	7.0	224.	6.3	223.	9.9	223.	7.2
250.	5.3	250.	6.2	253.	7.3	250.	3.8	250.	3.5	250.	3.8	250.	3.5	250.	3.6
275.	6.1	275.	6.4	255.	6.0	275.	2.4	275.	2.0	275.	2.5	275.	2.1	275.	2.1
300.	5.7	281.	6.3	275.	3.4	300.	1.0	300.	1.1	300.	1.2	300.	1.0	300.	1.3
309.	5.1	300.	4.0	300.	1.9	325.	.7	325.	.3	325.	.4	325.	.2	325.	.6
333.	2.0	325.	2.8	325.	1.8	350.	.1	350.	-.2	350.	-.2	350.	-.2	350.	0.0
350.	-.2	350.	.7	350.	.8	375.	-.5	375.	-.7	375.	-.8	375.	-.8	375.	-.4
381.	-1.3	375.	-1.4	375.	-.4	400.	-.9	400.	-1.0	400.	-1.1	400.	-.5	400.	-.8
400.	-2.2	400.	-2.5	400.	-2.0	425.	-2.2	425.	-1.4	425.	-1.6	425.	-1.1	425.	-1.2
425.	-3.7			422.	-3.4	450.	-3.5	450.	-2.4	450.	-2.6	450.	-1.9	450.	-1.8
												475.	-2.2	475.	-2.4
												500.	-3.1	500.	-3.6

LINE 8

DATE	720609	DATE	720625	DATE	720805	DATE	720929	DATE	721211	DATE	730115	DATE	730215	DATE	730315
SRVY	18	SRVY	19	SRVY	20	SRVY	21	SRVY	22	SRVY	23	SRVY	24	SRVY	25
171.	17.9	172.	17.7	172.	17.7	172.	17.7	172.	17.8	172.	18.1	172.	18.3	172.	18.2
189.	16.2	188.	16.1	190.	16.0	191.	16.0	191.	16.0	185.	16.6	191.	16.0	190.	15.9
201.	12.6	200.	12.8	200.	12.8	200.	12.8	200.	13.2	200.	13.1	200.	13.2	200.	12.9
218.	10.7	217.	11.0	217.	10.9	217.	10.9	216.	11.3	218.	11.0	216.	11.5	215.	10.9
221.	6.4	220.	9.7	222.	6.6	222.	6.8	222.	7.5	243.	5.5	220.	7.1	221.	7.0
249.	3.8	247.	3.7	248.	4.8	251.	6.2	250.	4.2	269.	2.4	245.	4.2	242.	5.1
275.	1.6	274.	2.1	274.	3.7	276.	4.0	275.	2.4	300.	.8	270.	2.6	267.	3.1
300.	1.2	300.	.9	300.	1.6	300.	2.4	300.	1.5	325.	.5	300.	1.3	292.	1.7
325.	1.0	325.	.2	325.	-.5	325.	1.3	325.	.6	350.	.2	325.	.6	300.	1.3
350.	.7	350.	-.3	350.	-1.2	350.	.6	350.	.1	375.	-.2	350.	.1	325.	.5
375.	.3	375.	-.8	375.	-1.6	375.	-.1	375.	-.4	400.	-.9	375.	-.4	350.	0.0
400.	-.4	400.	-1.5	400.	-1.4	400.	-1.3	400.	-.8	425.	-1.5	400.	-.4	375.	-.4
425.	-1.1	425.	-2.7	425.	-1.4	425.	-2.4	425.	-1.4	450.	-2.1	425.	-.6	400.	-.8
450.	-1.9	450.	-1.5	450.	-2.2			450.	-1.8	475.	-2.5	450.	-1.5	425.	-1.4
475.	-3.1	475.	-1.4	475.	-3.0			475.	-2.7	500.	-3.3	475.	-2.1	450.	-2.0
		500.	-2.7									500.	-3.0	475.	-2.6

LINE [illegible]

DATE	730328	DATE	730413	DATE	730614	DATE	730712	DATE	730809	DATE	731008	DATE	731205	DATE	740107
SRVY	26	SRVY	27	SRVY	28	SRVY	29	SRVY	30	SRVY	31	SRVY	32	SRVY	33
172.	17.6	172.	17.6	172.	17.5	172.	17.4	172.	17.6	172.	17.4	172.	17.4	172.	17.3
190.	16.3	185.	16.6	188.	16.4	186.	16.6	190.	16.3	187.	16.4	184.	16.6	186.	16.4
200.	12.9	200.	12.9	200.	12.8	200.	12.9	200.	12.9	211.	12.8	200.	12.6	200.	15.7
215.	11.5	217.	11.2	214.	11.7	215.	11.7	215.	11.7	224.	11.2	210.	11.3	209.	13.0
219.	7.4	219.	7.3	220.	7.0	224.	6.5	223.	9.5	231.	7.1	215.	6.6	222.	11.5
241.	5.1	244.	3.8	265.	4.8	250.	5.9	250.	6.3	251.	4.3	240.	5.2	229.	6.8
265.	3.3	282.	1.6	271.	4.8	275.	5.1	275.	3.8	277.	2.6	266.	3.4	260.	4.1
284.	1.9	300.	.9	300.	2.9	300.	2.7	300.	1.5	300.	.5	300.	2.0	285.	2.1
300.	1.1	325.	.3	325.	.1	325.	1.4	325.	.7	319.	-.4	325.	1.1	300.	1.2
325.	.2	350.	-.2	350.	-1.7	350.	-.6	350.	0.0	328.	.3	350.	-.3	325.	.6
350.	-.5	375.	-.8	375.	-2.1	375.	-1.9	375.	-.9	356.	.5	375.	-.3	350.	-.2
375.	-.8	400.	-1.3	400.	-2.2	400.	-2.6	400.	-1.7	375.	-.2	400.	-1.3	375.	-.9
400.	-1.4	425.	-2.2	425.	-2.6			425.	-2.7	400.	-1.3	425.	-2.1	400.	-1.4
425.	-2.1									425.	-2.4	450.	-2.8	425.	-1.9
450.	-2.3													450.	-2.5

LINE 8

DATE	740204	DATE	740308	DATE	740401	DATE	740530	DATE	740816	DATE	740930	DATE	741204
SRVY	34	SRVY	35	SRVY	36	SRVY	37	SRVY	38	SRVY	39	SRVY	40
172.	17.9	172.	17.5	172.	17.3	172.	17.5	172.	17.8	172.	17.8	172.	17.7
192.	15.9	190.	16.1	178.	18.0	191.	16.2	187.	16.5	190.	16.1	184.	16.7
200.	12.9	200.	12.9	190.	16.0	200.	13.3	200.	13.0	200.	13.1	195.	15.2
220.	11.7	214.	12.0	200.	12.8	216.	12.3	212.	12.1	214.	12.1	200.	12.5
245.	7.1	221.	5.7	212.	11.7	225.	6.1	225.	5.6	223.	6.6	208.	11.9
270.	4.5	246.	4.0	218.	6.9	250.	3.6	243.	5.3	250.	4.1	214.	6.3
300.	2.9	271.	2.3	233.	5.0	275.	2.2	273.	2.5	275.	2.4	225.	4.4
325.	1.5	300.	1.2	258.	2.9	300.	1.3	300.	1.4	300.	1.5	250.	2.5
350.	.5	325.	.5	282.	1.6	325.	.7	325.	.8	325.	.9	275.	1.6
375.	0.0	350.	-.1	300.	1.0	350.	.2	350.	.2	350.	.3	300.	.9
400.	-1.2	375.	-.7	325.	.3	375.	-.4	375.	-.3	375.	-.3	325.	.5
425.	-1.6	400.	-1.1	350.	-.3	400.	-.9	400.	-.8	400.	-.9	350.	-.5
450.	-3.8	425.	-1.9	375.	-.8	425.	-1.5	425.	-1.2	425.	-1.3	375.	-1.6
		450.	-2.4	400.	-1.4	450.	-2.0	450.	-1.8	445.	-2.4	400.	-2.2
				425.	-2.6	475.	-2.8	475.	-2.6			425.	-2.1
												450.	-1.6
												475.	-2.0

LINE 9

DATE	701113	DATE	701214	DATE	710114	DATE	710209	DATE	710309	DATE	710408	DATE	710510	DATE	710607
SRVY	2	SRVY	3	SRVY	4	SRVY	5	SRVY	6	SRVY	7	SRVY	8	SRVY	9
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186.	14.4	186.	14.5	186.	14.4	186.	14.6	186.	14.5	186.	14.4	186.	14.4	186.	14.3
200.	10.5	200.	10.7	200.	10.4	200.	10.9	200.	10.6	200.	10.5	200.	10.4	200.	10.2
234.	10.2	225.	9.4	225.	9.4	225.	9.6	225.	9.4	225.	9.3	225.	9.4	225.	9.5
245.	7.2	235.	10.2	236.	10.3	238.	9.3	235.	10.9	236.	10.8	237.	10.4	236.	10.8
270.	4.3	258.	5.3	243.	8.0	246.	6.5	250.	6.4	241.	6.9	240.	7.4	241.	7.3
295.	2.5	284.	4.9	265.	6.0	250.	6.0	275.	3.5	250.	6.1	250.	6.7	250.	6.6
300.	2.2	300.	3.7	275.	3.8	275.	4.3	300.	2.2	275.	5.1	275.	4.6	275.	5.0
325.	1.2	325.	2.1	300.	4.1	300.	2.7	325.	1.2	300.	4.2	300.	2.9	300.	4.3
350.	.8	350.	1.2	325.	3.8	325.	1.5	350.	.6	325.	2.5	325.	1.5	325.	1.6
375.	.6	375.	.2	350.	1.5	350.	.5	375.	0.0	350.	0.0	350.	.1	350.	-.4
400.	-.2	400.	-1.3	375.	.1	375.	-.4	400.	-1.6	375.	-2.1	375.	-1.2	375.	-2.3
425.	-1.1	425.	-2.7	400.	-1.2	400.	-1.2	425.	-3.4	385.	-2.6	400.	-2.5	400.	-4.3
450.	-2.4			425.	-2.7	425.	-2.6								
475.	-4.2			450.	-3.6										

LINE 9

DATE	710809	DATE	710831	DATE	711006	DATE	711214	DATE	720103	DATE	720208	DATE	720317	DATE	720413
SRVY	10	SRVY	11	SRVY	12	SRVY	13	SRVY	14	SRVY	15	SRVY	16	SRVY	17
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186.	14.4	186.	14.2	186.	14.5	186.	14.4	180.	14.4	186.	14.3	186.	14.4	166.	14.4
192.	12.9	200.	10.5	206.	9.5	200.	10.3	197.	11.0	200.	10.4	200.	10.5	200.	10.4
200.	10.4	220.	9.3	225.	9.4	225.	9.5	225.	9.5	225.	9.5	225.	9.5	225.	9.6
225.	9.4	236.	10.6	233.	10.9	236.	10.5	236.	10.3	237.	10.5	236.	10.9	235.	10.7
237.	10.5	243.	7.2	242.	7.6	241.	7.9	240.	7.9	242.	8.0	241.	8.0	242.	8.0
242.	7.3	262.	6.2	267.	6.5	266.	5.7	265.	5.9	279.	5.0	270.	5.2	252.	6.8
267.	6.7	287.	3.9	274.	6.6	291.	3.7	290.	3.7	300.	3.3	300.	2.5	275.	3.6
282.	4.2	300.	2.6	279.	5.7	300.	3.4	300.	3.0	325.	1.8	325.	.8	300.	2.2
300.	3.1	325.	.6	300.	3.1	325.	2.7	325.	1.8	350.	.7	350.	.4	325.	1.3
325.	2.0	350.	-.3	325.	2.0	350.	1.5	350.	1.0	375.	0.0	375.	-.3	350.	.8
350.	.9	375.	-.3	350.	.7	375.	.8	375.	.4	400.	-.8	400.	-.6	375.	-.3
375.	-.4	400.	-1.5	375.	-.7	400.	0.0	400.	-.2	425.	-1.3	425.	-.9	400.	-1.2
400.	-1.7	425.	-2.8	400.	-1.9	425.	-.7	425.	-.8	450.	-1.7	450.	-1.2	425.	-1.5
425.	-3.2			425.	-3.1	450.	-1.7	450.	-1.4	475.	-2.4	475.	-2.0	450.	-1.9
						475.	-2.8	475.	-2.1			500.	-3.0	475.	-2.3
								500.	-2.9					500.	-3.1

LINE 9

DATE 720609		DATE 720625		DATE 720805		DATE 720929		DATE 721211		DATE 730115		DATE 730215		DATE 730315	
SRVY	18	SRVY	19	SRVY	20	SRVY	21	SRVY	22	SRVY	23	SRVY	24	SRVY	25
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186.	14.4	187.	14.5	186.	14.4	186.	14.5	186.	14.4	186.	14.5	186.	14.4	186.	14.4
200.	10.3	197.	11.0	200.	10.5	200.	10.5	200.	10.6	200.	10.6	200.	10.6	200.	10.3
225.	9.5	223.	9.4	225.	9.6	207.	9.7	225.	9.5	223.	9.5	214.	9.5	225.	9.5
235.	11.0	236.	10.6	234.	11.3	227.	9.8	236.	10.7	236.	11.1	237.	11.3	235.	11.1
243.	6.1	240.	8.2	247.	6.8	236.	11.0	243.	7.7	250.	6.8	247.	7.5	244.	7.6
274.	5.3	268.	4.6	274.	4.6	247.	7.1	275.	4.6	275.	4.7	267.	5.1	277.	5.0
300.	2.1	288.	3.2	300.	2.7	264.	5.8	300.	2.8	300.	2.7	289.	3.1	300.	2.5
325.	1.7	300.	2.5	325.	1.9	281.	6.2	325.	1.5	325.	1.1	300.	2.5	325.	1.3
350.	1.0	325.	1.4	350.	.9	300.	3.9	350.	.8	350.	.7	325.	1.5	350.	.8
375.	.9	350.	.5	375.	.1	325.	2.4	375.	.2	375.	.5	350.	.6	375.	.2
400.	.8	375.	-.1	400.	-.3	350.	1.6	400.	-.2	400.	-.1	375.	-.1	400.	-.2
425.	.3	400.	-.7	425.	-1.0	375.	1.8	425.	-.7	425.	-.8	400.	-.6	425.	-.8
450.	-.5	425.	-.9	450.	-1.9	400.	.3	450.	-1.3	450.	-1.7	425.	-.7	450.	-1.4
475.	-1.5	450.	-2.0	475.	-3.1	425.	-1.0	475.	-2.1	475.	-2.3	450.	-1.1	475.	-2.1
500.	-2.0	475.	-2.9			450.	-2.0	500.	-3.1	500.	-3.0	475.	-1.9	500.	-2.7
						475.	-3.0					500.	-2.7		

LINE 9

DATE 730326		DATE 730413		DATE 730614		DATE 730712		DATE 730809		DATE 731008		DATE 731205		DATE 740107	
SRVY	26	SRVY	27	SRVY	28	SRVY	29	SRVY	30	SRVY	31	SRVY	32	SRVY	33
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186.	14.4	186.	14.4	186.	14.5	186.	14.5	186.	14.4	186.	14.2	186.	14.5	186.	14.5
200.	10.3	200.	10.2	200.	10.6	199.	10.8	200.	10.6	198.	10.8	200.	10.3	200.	10.5
225.	9.5	225.	9.6	229.	9.9	225.	9.5	235.	11.2	225.	9.6	225.	10.0	225.	9.7
235.	11.0	235.	11.3	235.	11.4	238.	11.2	250.	6.7	235.	11.3	233.	11.3	241.	11.5
243.	7.6	243.	8.0	245.	7.8	247.	7.0	275.	4.2	242.	7.6	244.	7.4	248.	8.1
263.	5.3	264.	4.8	270.	5.1	275.	4.2	300.	2.3	272.	4.5	275.	5.7	262.	4.2
292.	3.8	288.	2.4	300.	2.5	300.	2.6	325.	1.3	300.	3.1	300.	4.7	300.	2.8
300.	2.6	300.	1.7	325.	1.1	325.	1.8	350.	.5	325.	2.0	325.	2.6	325.	1.7
325.	1.6	325.	.9	350.	.3	350.	.4	375.	-.1	350.	1.4	350.	1.2	350.	1.0
350.	.9	350.	.3	375.	-.6	375.	-.9	400.	-.7	375.	1.1	375.	-.2	375.	.5
375.	-.1	375.	-.9	400.	-1.2	400.	-2.1	425.	-1.6	400.	.7	400.	-1.4	400.	-.3
400.	-1.1	400.	-2.0	425.	-2.2	425.	-3.3	450.	-2.3	425.	-.2	425.	-2.4	425.	-1.7
425.	-1.4	425.	-3.0	450.	-3.1			475.	-3.5	450.	-1.3	450.	-3.2	450.	-2.6
450.	-1.5									475.	-2.6				
475.	-1.8														
495.	-2.2														
520.	-2.7														

LINE 9

DATE	740204	DATE	740302	DATE	740401	DATE	740530	DATE	740816	DATE	740930	DATE	741204
SRVY	34	SRVY	35	SRVY	36	SRVY	37	SRVY	38	SRVY	39	SRVY	40
186.	14.5	186.	14.4	186.	14.5	186.	14.8	186.	14.5	186.	14.5	186.	14.5
200.	10.4	199.	11.0	200.	10.9	200.	10.5	200.	10.8	200.	10.7	197.	11.0
225.	9.6	225.	9.7	218.	9.5	225.	9.6	225.	9.6	225.	9.6	200.	10.4
250.	11.4	238.	10.1	239.	11.5	239.	11.5	237.	11.6	237.	11.5	225.	9.6
244.	7.8	240.	7.3	261.	5.4	249.	7.2	250.	6.0	247.	7.6	231.	11.2
272.	4.9	277.	4.0	286.	3.4	274.	4.1	268.	5.9	250.	7.1	245.	7.3
300.	2.9	300.	2.0	300.	2.6	300.	2.4	285.	3.7	275.	4.0	260.	4.0
325.	1.7	325.	.8	325.	1.5	325.	1.6	300.	2.0	300.	2.1	285.	2.0
350.	.9	350.	.1	350.	.3	350.	.7	325.	.3	325.	.2	300.	1.2
375.	.2	375.	-.5	375.	-.7	375.	-.2	350.	.1	350.	.8	325.	.6
400.	-.4	400.	-1.0	400.	-1.0	400.	-.8	375.	-.3	375.	.2	350.	-.1
425.	-.8	425.	-1.4	425.	-1.5	425.	-1.5	400.	-.7	400.	.5	375.	-.8
450.	-1.7	450.	-1.9	450.	-2.5	450.	-1.9	425.	-1.0	425.	-.2	400.	-1.4
475.	-2.9	475.	-2.6			475.	-2.7	450.	-1.7	450.	-.9	425.	-1.9
								475.	-2.3	471.	-2.3	450.	-2.4

LINE 10

DATE	701113	DATE	701215	DATE	710115	DATE	710209	DATE	710309	DATE	710408	DATE	710510	DATE	710607
SRVY	2	SRVY	3	SRVY	4	SRVY	5	SRVY	6	SRVY	7	SRVY	8	SRVY	9
222.	13.7	222.	13.6	222.	13.6	222.	13.7	222.	13.9	222.	13.8	222.	13.7	222.	13.7
235.	10.4	234.	10.5	232.	10.8	235.	10.7	225.	13.5	231.	11.3	232.	11.4	231.	11.8
237.	7.5	238.	7.0	236.	7.7	245.	6.8	231.	11.8	240.	7.7	240.	7.7	239.	7.9
264.	3.7	250.	5.7	270.	4.5	250.	6.0	240.	7.6	250.	7.1	257.	6.8	267.	6.7
294.	.5	277.	6.1	312.	5.8	268.	5.8	250.	6.4	275.	5.6	275.	2.6	274.	5.3
325.	1.2	300.	2.8	325.	3.6	275.	1.5	275.	4.1	300.	4.5	300.	3.8	300.	3.4
350.	.6	325.	1.6	350.	.7	300.	2.6	300.	2.3	325.	2.7	325.	1.8	325.	1.9
375.	.2	350.	.8	375.	-1.4	325.	.9	325.	1.0	350.	.2	350.	-.3	350.	.8
400.	-.3	375.	0.0	400.	-2.8	350.	-.2	350.	.1	365.	-1.5	375.	-.9	375.	.1
425.	-1.3	400.	-1.7			375.	-.4	375.	-.4	385.	-2.6	400.	-1.4	400.	-.8
450.	-2.7	425.	-2.8			400.	-1.3	400.	-.9			425.	-1.9	425.	-1.6
						425.	-2.2	425.	-2.2			450.	-2.7	450.	-2.6
						450.	-3.0	450.	-3.2						

LINE 10

DATE	710809	DATE	710831	DATE	711006	DATE	711214	DATE	720103	DATE	720208	DATE	720317	DATE	720413
SRVY	10	SRVY	11	SRVY	12	SRVY	13	SRVY	14	SHVY	15	SRVY	16	SHVY	17
222.	13.6	222.	13.7	222.	13.6	222.	13.7	222.	13.7	222.	13.7	222.	13.6	222.	13.7
225.	12.9	239.	8.3	231.	11.6	233.	10.8	233.	10.6	232.	10.5	233.	10.7	234.	10.7
232.	10.6	266.	6.5	242.	8.0	238.	6.2	237.	6.5	237.	6.6	237.	6.8	236.	7.3
243.	7.6	289.	5.7	254.	7.3	263.	3.9	262.	3.3	263.	3.9	268.	6.6	257.	4.2
249.	6.2	300.	4.6	256.	6.7	280.	2.9	287.	1.9	287.	2.4	283.	2.4	277.	2.8
280.	5.1	325.	1.9	291.	2.9	300.	1.7	300.	1.5	300.	1.6	300.	1.7	300.	1.7
300.	5.9	350.	.4	300.	2.1	319.	.2	325.	.6	325.	.5	325.	.9	325.	1.0
315.	6.3	375.	.2	325.	.4	344.	.5	350.	.1	350.	-.3	350.	-.1	350.	.7
325.	2.1	400.	-.5	350.	-.4	369.	0.0	375.	-.4	375.	-.8	375.	-.4	375.	-.2
361.	.4	425.	-1.8	375.	-.1	394.	-.7	400.	-.9	400.	-1.2	400.	-1.1	400.	-1.0
380.	-.6	450.	-3.0	400.	-.6	400.	-.9	425.	-1.2	425.	-1.6	425.	-1.4	425.	-2.0
400.	-1.4			425.	-1.3	425.	-1.0	450.	-1.6	450.	-2.1	450.	-1.8	448.	-2.6
				450.	-2.0	450.	-2.0	475.	-2.2			475.	-2.3	452.	-2.0
				475.	-2.8	475.	-2.5	500.	-2.7			500.	-2.8	475.	-1.7
														500.	-2.2
														525.	-2.6

LINE 10

DATE	720609	DATE	720625	DATE	720805	DATE	720929	DATE	721211	DATE	730115	DATE	730215	DATE	730315
SRVY	18	SHVY	19	SRVY	20	SHVY	21	SRVY	22	SRVY	23	SRVY	24	SHVY	25
222.	13.9	222.	13.8	222.	14.0	222.	13.8	222.	13.9	222.	13.7	222.	13.8	222.	13.7
226.	10.8	234.	10.8	233.	10.7	233.	10.7	232.	11.5	231.	13.0	231.	12.6	232.	12.2
236.	7.8	255.	7.7	237.	7.3	237.	7.5	235.	7.8	259.	8.0	237.	8.5	240.	7.1
262.	5.6	262.	5.3	256.	7.0	246.	6.8	270.	6.1	257.	5.8	239.	7.2	272.	3.4
248.	5.9	288.	3.9	268.	7.1	279.	7.1	300.	2.5	280.	3.1	268.	2.1	300.	1.5
300.	4.7	300.	2.8	281.	5.8	283.	6.1	325.	1.3	300.	2.0	300.	1.8	325.	.7
325.	2.5	325.	1.6	297.	5.6	300.	3.6	350.	.4	325.	.8	325.	.8	350.	.2
350.	1.0	350.	.5	325.	2.1	325.	2.1	375.	0.0	350.	.2	350.	.1	375.	-.1
375.	-.1	375.	-.1	340.	-.4	350.	1.1	400.	-.3	375.	-.2	375.	.5	400.	-.6
400.	-1.0	400.	-1.9	375.	-1.9	375.	.5	425.	-.6	400.	-.6	400.	0.0	425.	-1.0
425.	-2.3	425.	-2.2	400.	-2.8	400.	-.3	450.	-1.2	425.	-1.2	425.	-.8	450.	-1.6
450.	-2.2	450.	-2.3	425.	-2.6	425.	-1.0	475.	-2.0	450.	-1.7	450.	-1.7	475.	-2.6
475.	-2.7	475.	-2.6	450.	-1.7	450.	-1.9	500.	-2.7	475.	-2.3	475.	-2.4		
				475.	-1.8	475.	-2.4			500.	-2.8	500.	-3.1		
				500.	-1.4	500.	-3.0								
				525.	-2.0										
				550.	-2.6										

LINE 10

DATE	730328	DATE	730413	DATE	730614	DATE	730712	DATE	730809	DATE	731008	DATE	731205	DATE	740107
SRVY	26	SRVY	27	SRVY	28	SRVY	29	SRVY	30	SRVY	31	SRVY	32	SRVY	33
222.	13.8	222.	13.7	222.	13.7	222.	13.8	222.	13.9	222.	13.6	222.	13.6	222.	13.7
232.	11.4	233.	11.1	230.	11.7	231.	12.1	232.	12.6	230.	11.4	226.	11.5	233.	12.1
235.	7.6	236.	7.6	244.	7.9	238.	7.2	240.	6.8	235.	8.1	232.	7.8	234.	8.1
259.	5.1	259.	4.2	256.	4.5	263.	4.8	272.	5.1	254.	4.9	250.	5.4	263.	7.1
284.	3.2	282.	2.1	286.	3.4	300.	3.6	300.	2.7	285.	2.7	275.	5.2	271.	6.9
300.	2.2	300.	1.7	300.	3.3	325.	2.1	325.	1.2	300.	1.8	300.	5.2	300.	2.5
325.	1.2	325.	1.0	325.	2.0	350.	1.1	350.	.5	325.	1.1	325.	3.2	325.	1.3
350.	.4	350.	.8	350.	.8	375.	0.0	375.	-.2	350.	.7	350.	1.1	350.	.3
375.	-.3	375.	-.6	375.	-.7	400.	-1.0	400.	-1.3	375.	.3	375.	-.3	375.	-.4
400.	-.9	400.	-1.9	400.	-.7	425.	-1.9	425.	-2.2	400.	-.3	400.	-1.6	400.	-.8
425.	-1.9	425.	-2.7	425.	-1.1	450.	-2.8	450.	-3.5	425.	-1.0	425.	-2.2	425.	-1.3
435.	-2.3			450.	-1.5					450.	-1.7			450.	-2.2
450.	-2.5			475.	-2.0					475.	-2.5			475.	-2.6
				500.	-2.6										
				525.	-3.0										

LINE 10

DATE	740204	DATE	740305	DATE	740401	DATE	740530	DATE	740816	DATE	740930	DATE	741204
SRVY	34	SRVY	35	SRVY	36	SRVY	37	SRVY	38	SRVY	39	SRVY	40
222.	13.8	222.	13.7	222.	13.8	222.	13.9	222.	13.6	222.	13.7	222.	13.7
231.	12.8	231.	13.0	230.	13.1	232.	11.9	231.	11.9	230.	11.9	230.	12.0
237.	7.8	237.	7.9	238.	7.9	237.	8.7	255.	5.8	243.	7.3	237.	7.5
250.	7.0	252.	5.6	248.	4.3	257.	5.4	273.	5.5	250.	6.7	258.	4.6
268.	3.1	275.	4.1	300.	2.0	289.	3.3	300.	2.6	275.	4.4	284.	2.1
300.	2.1	300.	1.9	325.	1.0	300.	2.7	325.	1.2	300.	2.7	300.	1.8
325.	1.0	325.	1.0	350.	.3	325.	1.8	350.	.9	325.	1.7	325.	1.0
350.	.3	350.	.2	375.	-.2	350.	1.1	375.	.5	350.	1.0	350.	.4
375.	-.3	375.	-.3	400.	-.7	375.	.5	400.	-.1	375.	.3	375.	-.2
400.	-.7	400.	-.7	425.	-1.9	400.	-.2	425.	-1.1	400.	-.2	400.	-.6
425.	-1.2	425.	-1.1	450.	-2.7	425.	.1	450.	-1.9	425.	-.4	425.	-1.6
450.	-1.5	450.	-2.3			450.	-.7	475.	-2.4	450.	-1.3	450.	-2.3
475.	-2.0					475.	-1.7			470.	-2.2		
500.	-2.3					500.	-2.5						
525.	-2.6												

LINE 11

DATE	701113	DATE	701215	DATE	710115	DATE	710209	DATE	710309	DATE	710408	DATE	710510	DATE	710607
SRVY	2	SRVY	3	SRVY	4	SRVY	5	SRVY	6	SRVY	7	SRVY	8	SRVY	9
173.	16.8	173.	16.8	173.	16.8	173.	16.7	173.	16.8	173.	16.6	173.	16.5	173.	16.4
190.	12.1	188.	12.3	188.	12.4	202.	10.4	175.	16.6	200.	11.3	191.	11.6	191.	11.6
203.	10.5	205.	10.8	200.	10.8	217.	8.8	187.	13.4	209.	10.0	200.	10.4	200.	10.5
212.	7.7	214.	7.7	225.	5.7	225.	5.9	200.	11.1	225.	6.7	204.	9.7	206.	9.4
237.	6.2	242.	5.6	250.	4.2	250.	3.8	216.	7.0	250.	5.7	213.	7.5	216.	7.3
270.	3.6	270.	6.0	275.	3.8	275.	2.1	225.	5.8	275.	4.0	225.	6.4	225.	6.4
300.	2.0	300.	3.9	300.	2.9	300.	1.0	250.	3.5	300.	4.6	250.	6.1	250.	6.3
325.	1.2	325.	1.4	325.	2.2	325.	.2	269.	2.3	325.	2.4	275.	4.0	265.	5.0
350.	.5	350.	-.4	350.	1.0	350.	-.5	275.	2.4	350.	-.1	300.	2.0	275.	5.3
375.	-.5	375.	-1.9	375.	-.3	375.	-1.0	300.	2.7	370.	-1.3	325.	.3	290.	5.5
400.	-1.5	400.	-2.9	400.	-1.5	400.	-1.5	325.	2.0	385.	-2.3	350.	-.9	300.	4.5
425.	-3.0			425.	-3.1	425.	-2.1	350.	1.2			375.	-2.0	325.	1.3
						450.	-3.0	375.	.5			400.	-3.0	350.	-.5
								400.	-.6					375.	-2.9
								425.	-3.5						

LINE 11

DATE	710809	DATE	710831	DATE	711006	DATE	711218	DATE	720103	DATE	720209	DATE	720317	DATE	720417
SRVY	10	SRVY	11	SRVY	12	SRVY	13	SRVY	14	SRVY	15	SRVY	16	SRVY	17
173.	16.0	173.	16.5	173.	16.7	173.	16.6	173.	16.5	173.	16.5	173.	16.7	173.	17.8
180.	12.2	194.	11.0	181.	14.9	179.	16.1	179.	15.9	179.	16.2	176.	16.8	190.	12.0
200.	10.5	203.	9.5	200.	10.4	200.	10.4	193.	11.4	200.	10.5	200.	10.8	200.	10.8
205.	9.4	221.	6.7	215.	7.5	225.	7.0	200.	10.4	212.	8.3	225.	7.1	225.	7.1
227.	6.4	246.	6.5	240.	6.7	250.	4.4	206.	9.6	237.	6.3	250.	4.1	250.	4.2
263.	6.0	255.	6.6	264.	7.2	275.	3.0	213.	8.2	263.	3.8	275.	2.2	275.	2.5
268.	6.4	280.	3.7	267.	5.9	300.	1.6	236.	6.2	287.	2.5	300.	1.3	300.	1.5
285.	4.8	300.	2.0	293.	3.0	325.	.7	261.	3.3	300.	1.8	325.	.4	325.	.7
300.	2.9	325.	.8	300.	2.5	350.	-.1	286.	1.9	325.	.8	350.	-.2	350.	.1
325.	1.4	350.	.4	325.	1.7	375.	-.4	300.	1.3	350.	.2	375.	-.1	375.	-.5
350.	0.0	375.	-.1	350.	.8	400.	-1.1	325.	.5	375.	-.4	400.	-.6	400.	-.9
375.	-1.0	400.	-1.2	375.	-.3	420.	-2.1	350.	0.0	400.	-1.2	425.	-1.4	425.	-1.3
400.	-2.3	425.	-2.5	400.	-1.8	435.	-2.8	375.	-.4	425.	-2.0	450.	-2.7	450.	-2.3
				425.	-3.3			400.	-.9	436.	-2.5			475.	-3.1
								425.	-1.6						
								450.	-2.6						

LINE 11

DATE	720609	DATE	720625	DATE	720805	DATE	720929	DATE	721211	DATE	730115	DATE	730215	DATE	730315
SRVY	18	SRVY	19	SRVY	20	SRVY	21	SRVY	22	SRVY	23	SRVY	24	SRVY	25
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173.	17.0	173.	17.0	173.	17.2	172.	17.1	173.	17.2	173.	17.3	173.	17.2	173.	17.3
175.	17.0	176.	17.2	177.	16.6	175.	17.1	176.	17.0	177.	17.4	177.	17.3	192.	12.4
193.	11.4	189.	12.3	187.	13.4	188.	12.6	200.	10.5	200.	10.7	190.	12.5	200.	11.6
200.	10.5	200.	10.5	200.	11.5	200.	10.3	225.	7.2	225.	6.5	200.	10.7	225.	7.7
225.	6.8	220.	7.4	223.	7.1	223.	7.1	250.	4.3	250.	4.1	214.	8.5	238.	5.6
250.	4.6	247.	4.8	239.	6.5	252.	7.1	275.	2.6	275.	1.8	220.	7.4	263.	4.5
275.	3.0	276.	2.5	257.	5.0	253.	6.6	300.	1.3	300.	.9	245.	4.8	290.	2.7
300.	2.0	300.	1.2	282.	3.5	276.	3.2	325.	.6	325.	.9	268.	2.9	300.	2.3
325.	1.4	325.	.5	300.	1.5	300.	1.7	350.	.1	350.	.4	291.	1.8	325.	1.2
350.	.7	350.	0.0	325.	-1.1	325.	1.0	375.	-.3	375.	-.3	300.	1.5	350.	.9
375.	.1	375.	-.5	350.	-1.7	350.	.5	400.	-1.0	400.	-1.2	325.	.9	375.	.6
400.	-.7	400.	-1.3	375.	-1.2	375.	-.6	425.	-1.3	425.	-1.7	350.	.6	400.	-.1
425.	-1.6	425.	-1.9	400.	-1.3	400.	-1.2	450.	-2.0	450.	-2.5	375.	-.1	425.	-.5
450.	-2.0	450.	-2.7	425.	-1.8	425.	-2.0	475.	-2.8	475.	-3.0	400.	-.2	450.	-1.5
		475.	-2.6	450.	-2.0	450.	-2.6					425.	-.8	475.	-2.5
												450.	-1.5		
												470.	-2.1		
												500.	-2.6		

LINE 11

DATE	730328	DATE	730413	DATE	730614	DATE	730712	DATE	730810	DATE	731206	DATE	740108	DATE	740205
SRVY	26	SRVY	27	SRVY	28	SRVY	29	SRVY	30	SRVY	32	SRVY	33	SRVY	34
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173.	17.1	173.	17.0	173.	17.2	173.	17.3	173.	17.2	173.	17.4	173.	17.2	173.	17.3
177.	17.5	176.	17.4	176.	17.5	176.	17.6	189.	13.1	175.	17.6	176.	17.3	176.	17.6
188.	12.9	191.	12.3	191.	12.7	186.	13.4	200.	10.5	191.	12.9	188.	13.6	194.	12.5
200.	10.7	200.	10.8	200.	10.6	218.	7.5	225.	7.1	200.	11.1	200.	10.6	200.	10.7
225.	7.1	225.	6.7	225.	6.5	250.	6.6	250.	6.7	220.	7.7	216.	8.1	225.	7.4
250.	5.1	250.	3.4	250.	6.1	275.	4.6	275.	4.3	250.	5.7	245.	6.4	250.	5.6
275.	3.7	275.	2.1	275.	4.0	300.	2.6	300.	2.3	275.	3.9	256.	6.6	275.	3.2
300.	2.0	300.	1.2	300.	2.0	325.	1.1	325.	.9	300.	2.8	283.	3.1	300.	1.5
325.	.6	325.	.9	325.	.4	350.	-.6	350.	.2	325.	1.4	300.	1.6	325.	.7
350.	-.9	350.	.1	350.	-.9	375.	-2.0	375.	-.9	350.	.5	325.	.7	350.	.4
375.	-1.4	375.	-1.2	375.	-1.9	400.	-2.0	400.	-1.5	375.	-.3	350.	-.2	375.	-.5
400.	-2.1	400.	-2.4	400.	-1.9	425.	-2.1	425.	-1.2	400.	-1.4	375.	-1.0	400.	-1.0
425.	-3.0	425.	-3.3	425.	-1.6	450.	-2.8	450.	-2.6	420.	-2.5	400.	-2.4	425.	-1.4
				450.	-2.2	475.	-3.0							450.	-1.8
				475.	-2.9									475.	-2.5

LINE 11

DATE	740305	DATE	740402	DATE	740531	DATE	740816	DATE	741001	DATE	741204
SRVY	35	SRVY	36	SRVY	37	SRVY	38	SRVY	39	SRVY	40
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173.	17.1	173.	17.3	173.	17.5	173.	17.4	173.	17.5	173.	17.3
187.	14.3	177.	17.7	180.	13.7	200.	11.7	190.	13.8	185.	10.7
200.	11.2	189.	14.0	200.	10.8	225.	7.3	200.	12.1	200.	11.4
225.	6.9	200.	11.4	230.	6.0	250.	5.5	225.	7.3	219.	7.5
250.	5.0	225.	7.3	250.	4.5	275.	3.6	250.	5.6	243.	4.7
275.	3.5	250.	5.2	275.	3.1	300.	2.0	275.	3.9	268.	2.7
300.	2.1	275.	1.8	300.	2.1	325.	1.6	300.	2.3	290.	1.8
325.	.5	300.	1.0	325.	1.3	350.	.9	325.	1.6	300.	1.6
350.	-1.1	325.	.5	350.	.7	375.	.3	350.	.9	325.	.8
375.	-2.1	350.	.1	375.	0.0	400.	-.4	375.	.2	350.	.8
400.	-1.9	375.	-1.0	400.	-.3	425.	-1.2	400.	.5	375.	-.8
425.	-1.7	400.	-2.4	425.	-.6	450.	-1.8	425.	.1	400.	-2.0
450.	-2.2	425.	-2.7	450.	-1.4	475.	-2.6	450.	-1.2	425.	-2.8
475.	-2.5			475.	-2.4			475.	-2.1		
				500.	-3.1			500.	-3.2		

LINE 12

DATE	701110	DATE	701215	DATE	710115	DATE	710209	DATE	710309	DATE	710409	DATE	710511	DATE	710608
SRVY	2	SRVY	3	SRVY	4	SRVY	5	SRVY	6	SRVY	7	SRVY	8	SRVY	9
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188.	10.6	188.	10.6	188.	10.6	188.	10.8	188.	10.8	188.	10.7	188.	10.6	188.	10.8
207.	9.6	220.	10.0	200.	9.8	200.	10.2	200.	10.0	200.	10.0	200.	9.9	200.	10.0
221.	10.0	223.	7.1	220.	10.1	217.	9.4	217.	9.5	216.	9.6	217.	9.1	217.	9.1
223.	7.1	241.	5.7	224.	5.7	225.	5.9	222.	6.7	221.	7.2	221.	7.4	221.	7.4
243.	5.3	272.	6.8	250.	5.1	244.	5.9	225.	6.4	225.	6.8	250.	6.9	225.	6.9
265.	4.1	300.	3.7	275.	5.4	250.	5.4	250.	4.5	250.	4.8	275.	3.7	250.	6.9
290.	4.4	325.	1.0	288.	5.6	275.	3.2	275.	2.9	275.	3.0	300.	1.6	275.	4.8
312.	1.9	350.	-.8	300.	4.5	300.	1.5	300.	1.3	300.	2.0	325.	.5	300.	2.5
340.	.5	375.	-2.9	325.	1.9	325.	.3	325.	.3	325.	.9	350.	-.5	325.	.3
365.	-1.1			350.	-.2	350.	-.5	350.	-.6	350.	-.8	375.	-1.5	350.	-.6
390.	-2.6			375.	-2.2	375.	-1.1	375.	-1.5	375.	-2.7	385.	-2.3	375.	-1.7
				400.	-3.8	400.	-1.8	400.	-2.0					395.	-3.0
						425.	-2.5	425.	-2.6						

LINE 12

DATE	710810	DATE	710831	DATE	711007	DATE	711215	DATE	720103	DATE	720209	DATE	720317	DATE	720817
SRVY	10	SRVY	11	SRVY	12	SRVY	13	SRVY	14	SRVY	15	SRVY	16	SRVY	17
188.	10.8	188.	11.0	188.	11.2	188.	11.0	188.	11.0	188.	11.0	188.	11.2	188.	11.4
200.	10.1	200.	9.7	200.	9.7	200.	9.8	200.	9.7	200.	10.0	200.	9.9	200.	9.8
215.	9.0	215.	8.8	218.	8.4	217.	8.9	217.	8.5	217.	8.9	216.	10.0	218.	9.4
219.	7.5	224.	7.2	223.	7.7	223.	7.7	225.	7.4	220.	7.6	227.	7.2	225.	7.6
244.	7.0	247.	6.9	248.	7.1	248.	4.8	250.	4.9	245.	5.2	250.	4.5	250.	4.3
253.	6.6	272.	3.7	250.	6.3	273.	3.5	275.	2.9	270.	3.2	275.	2.5	275.	2.5
265.	5.3	300.	1.7	275.	3.6	300.	2.4	300.	1.8	295.	1.9	300.	1.6	300.	1.6
280.	4.9	325.	1.0	300.	2.2	325.	1.5	325.	1.0	300.	1.6	325.	.7	325.	.9
300.	2.5	350.	0.0	325.	.7	350.	1.0	350.	.4	325.	.7	350.	0.0	350.	-.2
325.	1.0	375.	-1.4	350.	[illegible]	375.	0.0	375.	-.1	350.	.2	375.	-.6	375.	-.9
350.	-.5	400.	-2.9	375.	-.3	400.	-1.3	400.	-.7	375.	-.4	400.	-.9	400.	-1.1
375.	-1.7			400.	-1.0	425.	-2.6	425.	-1.7	400.	-1.2	425.	-1.2	425.	-1.1
400.	-2.9			425.	-1.9			450.	-2.7	425.	-2.0	450.	-1.7	450.	-1.4
				450.	-3.7					450.	-2.9	475.	-2.7	475.	-2.0
														500.	-2.8

LINE 12

DATE	720609	DATE	720625	DATE	720805	DATE	720929	DATE	721211	DATE	730116	DATE	730215	DATE	730316
SRVY	18	SRVY	19	SRVY	20	SRVY	21	SRVY	22	SRVY	23	SRVY	24	SRVY	25
188.	11.5	188.	11.2	188.	11.3	188.	11.5	188.	11.6	188.	11.6	188.	11.7	188.	11.5
200.	10.1	200.	10.2	200.	9.7	200.	10.0	200.	9.9	200.	10.2	216.	10.9	200.	9.6
218.	9.6	219.	8.3	225.	7.8	205.	10.8	225.	6.2	215.	9.3	219.	9.1	216.	9.6
221.	8.2	240.	7.1	246.	6.8	211.	9.5	250.	5.8	247.	5.6	249.	4.9	220.	8.9
240.	7.0	262.	4.3	257.	5.7	227.	7.9	275.	3.6	273.	3.4	275.	2.0	245.	5.8
268.	4.5	285.	2.1	274.	5.8	250.	7.2	300.	1.7	300.	1.8	300.	1.6	270.	3.6
293.	1.0	300.	1.1	300.	1.7	266.	7.0	325.	1.0	325.	1.0	325.	.7	300.	1.9
300.	.6	325.	.2	325.	-.9	281.	4.7	350.	.4	350.	.3	350.	-.1	325.	.8
320.	0.0	350.	-.9	350.	-1.7	300.	2.8	375.	-.1	375.	-.4	375.	-.8	350.	.2
325.	.6	375.	-1.1	375.	-2.4	325.	1.3	400.	-.5	400.	-.8	400.	-1.3	375.	-.5
350.	.7	400.	-1.9	400.	-1.4	350.	.9	425.	-1.5	425.	-1.4	425.	-1.1	400.	-.9
375.	.4	425.	-1.2	425.	-1.6	375.	.1	450.	-2.6	450.	-2.5	450.	-1.6	425.	-1.6
400.	-.3	450.	-1.5	450.	-2.3	400.	-.7	476.	-3.7	475.	-3.5	475.	-2.0	450.	-2.2
425.	-1.0	475.	-2.1	475.	-3.1	425.	-1.9					500.	-3.3	475.	-2.7
450.	-1.7	500.	-2.7			450.	-2.7								
475.	-2.5														

LINE 12

DATE	730329	DATE	730416	DATE	730615	DATE	730713	DATE	730810	DATE	731008	DATE	731206	DATE	740108
SRVY	26	SRVY	27	SRVY	28	SRVY	29	SRVY	30	SRVY	31	SRVY	32	SRVY	33
188.	11.3	188.	11.6	188.	11.8	188.	11.6	188.	11.6	188.	11.9	188.	12.0	188.	12.1
200.	10.2	200.	10.6	200.	9.9	200.	10.0	200.	10.2	200.	10.5	200.	10.6	200.	10.8
218.	9.0	216.	10.5	219.	8.7	216.	8.8	212.	8.6	218.	9.3	216.	9.3	218.	10.4
225.	7.4	225.	6.2	230.	6.9	225.	6.9	225.	6.7	225.	7.3	225.	7.4	219.	7.8
250.	5.0	250.	3.3	250.	6.3	250.	6.9	250.	7.0	250.	7.1	250.	6.7	243.	7.0
275.	3.3	275.	2.0	275.	4.3	261.	6.9	260.	7.0	275.	4.7	275.	5.9	272.	3.8
300.	1.7	300.	1.0	300.	1.2	277.	4.5	273.	5.0	300.	3.0	300.	3.0	300.	1.8
325.	.8	325.	.1	325.	-1.8	300.	2.4	300.	2.4	325.	1.8	320.	1.2	325.	.7
350.	.2	350.	-.5	350.	-1.5	325.	1.1	325.	.9	350.	1.5	350.	.2	350.	-.1
375.	-.4	375.	-1.4	375.	-2.0	350.	.1	350.	.2	375.	.3	375.	-1.0	375.	-.7
400.	-.9	400.	-2.2	400.	-2.2	375.	-.9	375.	-.9	400.	-.7	400.	-2.0	400.	-1.0
425.	-1.4	425.	-3.0	425.	-3.3	400.	-2.0	400.	-1.6	425.	-2.4	415.	-2.9	418.	-1.5
436.	-2.0					425.	-2.3	425.	-2.6	450.	-3.2			435.	-2.6
450.	-2.2					450.	-2.7								
475.	-2.8														

LINE 12

DATE	740205	DATE	740305	DATE	740402	DATE	740531	DATE	740816	DATE	741001	DATE	741204
SRVY	34	SRVY	35	SRVY	36	SRVY	37	SRVY	38	SRVY	39	SRVY	40
188.	12.1	188.	12.1	188.	12.3	188.	12.2	188.	12.4	188.	12.4	188.	12.1
200.	10.7	200.	10.2	200.	10.7	200.	11.1	200.	10.9	200.	11.2	195.	12.6
217.	9.7	215.	9.0	218.	8.6	219.	10.1	217.	9.6	215.	10.1	200.	11.2
224.	7.6	244.	5.6	242.	5.7	230.	7.3	239.	6.1	225.	7.8	222.	7.3
235.	7.4	265.	3.6	270.	3.2	250.	5.5	259.	5.9	250.	6.1	247.	4.6
260.	4.8	300.	1.5	300.	1.6	275.	3.4	280.	3.3	275.	3.8	273.	2.2
285.	2.4	325.	.5	325.	.8	300.	2.1	300.	1.4	300.	1.9	300.	1.4
300.	1.6	350.	0.0	350.	-.1	325.	1.2	325.	.7	325.	1.2	325.	.7
325.	.7	375.	-.6	375.	-1.1	350.	.5	350.	0.0	350.	.5	350.	0.0
350.	0.0	400.	-1.2	400.	-2.0	375.	-.3	375.	-.7	375.	-.2	375.	-1.0
375.	-.4	425.	-1.9	425.	-2.3	400.	-.9	400.	-1.6	400.	.3	400.	-1.9
400.	-.7	450.	-2.5	450.	-1.7	425.	-1.5	425.	-2.5	425.	-.2	425.	-2.2
425.	-1.2			475.	-2.3	450.	-2.2			450.	-1.2	450.	-1.3
450.	-1.8			500.	-2.8	475.	-2.5			475.	-2.2	475.	-1.6
475.	-2.4									500.	-3.2	500.	-2.7

LINE 13

DATE	701116	DATE	701215	DATE	710115	DATE	710210	DATE	710309	DATE	710409	DATE	710511	DATE	710608
SRVY	2	SRVY	3	SRVY	4	SRVY	5	SRVY	6	SRVY	7	SRVY	8	SRVY	9
183.	14.0	183.	14.0	183.	14.0	183.	13.9	183.	13.9	183.	13.8	183.	13.8	183.	13.8
197.	10.5	197.	10.5	200.	10.5	200.	10.6	196.	10.6	200.	10.5	200.	10.4	195.	10.3
214.	11.2	215.	11.2	215.	11.5	215.	9.9	200.	10.5	215.	10.2	216.	10.0	200.	10.5
218.	7.3	219.	7.1	223.	6.7	220.	7.0	212.	11.1	219.	7.7	219.	8.0	214.	9.9
234.	5.2	231.	5.8	250.	5.3	225.	6.3	218.	7.7	225.	7.0	225.	7.2	217.	7.9
250.	4.0	260.	6.3	275.	5.7	250.	5.7	225.	6.9	250.	5.5	250.	4.7	225.	6.7
275.	4.0	288.	3.8	300.	3.5	275.	3.3	250.	4.6	275.	4.4	275.	3.4	250.	5.7
300.	1.8	300.	2.8	325.	1.3	300.	1.2	275.	2.7	290.	4.3	300.	2.4	270.	5.9
325.	.2	325.	.7	350.	-1.2	325.	.1	300.	1.0	300.	3.1	325.	1.0	275.	5.1
350.	-1.2	350.	-1.6	375.	-2.9	350.	-.7	325.	0.0	325.	.1	350.	-.4	300.	2.2
375.	-2.4	375.	-3.0			375.	-.9	350.	-.9	350.	-2.3	375.	-1.8	325.	.4
390.	-3.3					400.	-1.7	375.	-1.6	363.	-2.9	400.	-2.7	350.	-.9
						425.	-2.7	400.	-2.3					375.	-1.9
								425.	-3.1					400.	-2.5

LINE 13

DATE	710810	DATE	710901	DATE	711007	DATE	711215	DATE	720108	DATE	720209	DATE	720317	DATE	720417
SRVY	10	SRVY	11	SRVY	12	SRVY	13	SRVY	14	SRVY	15	SRVY	16	SRVY	17
183.	13.8	183.	13.8	183.	13.7	183.	13.8	183.	14.0	183.	13.8	183.	13.6	183.	14.0
189.	12.7	196.	10.1	197.	10.5	197.	10.5	198.	10.5	200.	10.8	200.	10.5	197.	10.5
197.	10.3	214.	11.7	212.	10.0	209.	10.8	213.	10.5	211.	10.1	213.	11.7	208.	10.8
200.	10.6	219.	7.7	218.	8.2	214.	11.9	219.	8.3	217.	8.8	219.	6.7	214.	11.9
213.	10.7	244.	6.6	234.	7.0	219.	8.3	244.	6.0	243.	6.0	245.	5.6	218.	8.7
218.	7.8	253.	6.3	236.	6.3	244.	5.7	269.	3.7	267.	4.5	274.	2.9	242.	5.5
243.	6.5	278.	5.8	261.	3.6	269.	3.9	294.	2.2	293.	3.0	300.	1.7	266.	2.9
253.	6.5	300.	2.4	286.	2.3	298.	3.8	300.	1.9	300.	2.5	325.	.7	283.	2.0
270.	6.0	325.	.9	300.	2.1	300.	3.7	325.	1.2	325.	1.2	350.	.1	300.	1.5
300.	2.7	350.	-.7	325.	1.1	325.	1.9	350.	.7	350.	.5	375.	-.3	325.	1.0
325.	.5	375.	-2.2	350.	-.2	350.	1.2	375.	.1	375.	0.0	400.	-.4	350.	.1
350.	-1.1	386.	-2.6	375.	-1.9	375.	.3	400.	-1.0	400.	-.6	425.	-.4	375.	-.8
375.	-2.6			400.	-3.9	400.	-.9	425.	-2.1	425.	-1.5	450.	-1.4	400.	-1.6
						425.	-2.2	438.	-2.7	450.	-2.5	475.	-2.4	425.	-1.9
						450.	-3.3							450.	-2.1
														475.	-2.5

LINE 13

DATE 720609	SRVY 18	DATE 720625	SRVY 19	DATE 720805	SRVY 20	DATE 720929	SRVY 21
183.	13.8	183.	13.9	183.	14.0	183.	13.8
197.	10.7	198.	10.9	197.	10.7	197.	10.8
209.	10.8	213.	11.8	212.	12.0	210.	11.1
213.	11.9	217.	8.8	217.	8.8	214.	11.9
216.	8.7	228.	7.2	237.	5.6	219.	8.7
232.	6.4	250.	4.3	263.	4.2	233.	6.2
257.	4.7	275.	2.4	282.	3.0	255.	6.0
281.	2.0	300.	1.1	300.	1.8	276.	4.7
300.	1.2	325.	.4	325.	.5	300.	3.0
325.	.8	350.	-.2	350.	.2	325.	1.8
350.	.7	375.	-.7	375.	-.2	350.	.8
375.	.3	400.	-.6	400.	-.9	375.	0.0
400.	-.3	425.	-1.4	425.	-1.5	400.	-.3
425.	-.9	450.	-2.7	450.	-2.1	425.	-1.8
450.	-1.8			475.	-2.8	450.	-2.9
475.	-2.4						

DATE 721211	SRVY 22	DATE 730116	SRVY 23	DATE 730215	SRVY 24	DATE 730316	SRVY 25
183.	13.9	183.	13.9	185.	13.9	183.	14.1
196.	10.9	200.	10.8	196.	11.0	197.	11.1
200.	10.9	215.	11.6	213.	11.7	212.	11.7
212.	12.0	221.	8.5	218.	9.0	218.	8.6
225.	7.6	246.	5.5	237.	6.3	238.	6.2
250.	5.3	271.	4.1	258.	4.3	257.	5.5
275.	3.5	300.	2.4	280.	2.9	281.	3.2
300.	2.0	325.	1.4	300.	2.0	300.	2.0
325.	1.2	350.	.4	325.	1.1	325.	1.0
350.	.7	375.	.3	350.	.3	350.	.4
375.	.1	400.	-.7	375.	-.4	375.	-.2
400.	-.6	425.	-1.9	400.	-1.0	400.	-.9
425.	-1.2	450.	-3.1	425.	-1.5	425.	-1.6
450.	-2.7			450.	-2.3	450.	-2.6
				475.	-3.5		

LINE 13

DATE 730329	SRVY 26	DATE 730416	SRVY 27	DATE 730615	SRVY 28	DATE 730713	SRVY 29
183.	13.8	183.	13.8	183.	13.8	183.	13.8
200.	10.8	196.	11.0	197.	10.8	200.	11.1
210.	10.9	209.	11.1	214.	10.9	213.	12.0
215.	12.1	212.	12.1	220.	8.2	223.	7.6
219.	9.3	225.	7.4	245.	5.5	250.	6.3
243.	5.8	250.	4.0	270.	4.4	275.	3.8
260.	4.0	275.	1.9	300.	1.7	300.	1.7
275.	2.8	300.	1.2	325.	-.6	325.	.6
300.	1.3	325.	.1	350.	-1.2	350.	-.4
325.	.4	350.	-.4	375.	-2.0	374.	-2.4
350.	0.0	375.	-1.4	400.	-2.5	400.	-2.9
375.	-.5	400.	-2.0	425.	-2.8		
400.	-.8	438.	-1.5				
425.	-1.3	460.	-1.6				
450.	-2.0	485.	-2.2				
475.	-2.8	500.	-2.7				

DATE 730810	SRVY 30	DATE 731008	SRVY 31	DATE 731206	SRVY 32	DATE 740108	SRVY 33
183.	13.8	183.	14.0	183.	13.9	183.	14.1
200.	11.3	200.	11.3	200.	11.3	200.	11.3
211.	11.4	214.	11.5	213.	12.0	212.	11.8
225.	7.3	219.	8.3	219.	8.5	218.	8.6
250.	6.7	233.	6.9	236.	7.2	241.	6.5
275.	4.6	260.	4.1	261.	4.8	275.	3.3
300.	2.1	287.	2.6	285.	3.2	300.	1.5
325.	.4	297.	.8	300.	2.1	323.	.4
350.	-1.5	300.	1.3	325.	.9	350.	-.5
375.	-1.2	325.	1.3	350.	-.4	375.	-1.0
400.	-2.2	350.	.5	375.	-1.3	400.	-1.4
425.	-2.5	375.	-.6	400.	-2.6	425.	-1.8
		400.	-1.8			444.	-2.8
		425.	-3.3				

LINE 13

DATE	740205	DATE	740305	DATE	740402	DATE	740531	DATE	740816	DATE	741001	DATE	741204
SRVY	34	SRVY	35	SRVY	36	SRVY	37	SRVY	38	SRVY	39	SRVY	40
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183.	14.1	183.	13.8	183.	14.0	183.	14.1	183.	14.1	183.	14.0	183.	13.9
200.	11.4	198.	11.0	197.	11.2	197.	11.7	200.	11.7	194.	11.9	200.	11.8
213.	11.8	215.	11.8	200.	11.2	215.	12.1	214.	11.6	200.	11.8	212.	11.1
219.	8.6	223.	8.2	213.	11.7	223.	9.0	235.	6.3	214.	10.3	227.	6.6
230.	7.5	247.	5.0	227.	7.4	243.	5.6	250.	5.5	225.	7.8	250.	3.7
255.	4.9	273.	2.6	250.	4.1	256.	4.1	275.	3.4	250.	5.7	275.	1.8
280.	2.6	300.	1.4	275.	1.9	282.	2.3	300.	1.8	275.	3.1	300.	1.2
300.	1.5	325.	.6	300.	.9	300.	1.6	325.	1.0	300.	1.7	325.	.1
325.	.6	350.	-.2	325.	.3	325.	1.1	350.	.2	325.	.9	350.	-1.1
350.	-.1	375.	-.9	350.	-.7	350.	.3	375.	-.5	350.	.1	375.	-1.7
375.	-.2	400.	-1.5	375.	-1.7	375.	0.0	400.	-1.0	375.	-.2	400.	-2.2
400.	-.7	425.	-2.1	400.	-2.3	400.	-.9	425.	-1.5	400.	0.0		
425.	-1.5	450.	-2.3	425.	-1.8	425.	-1.8	450.	-2.0	425.	-.8		
450.	-2.1	475.	-3.0	450.	-1.8	450.	-1.9	475.	-2.6	450.	-1.8		
475.	-2.8			475.	-2.4	475.	-1.9			475.	-2.9		
				500.	-3.0	500.	-2.0						
						525.	-3.5						

LINE 14

DATE	701116	DATE	701215	DATE	710118	DATE	710210	DATE	710310	DATE	710409	DATE	710511	DATE	710608
SRVY	2	SRVY	3	SRVY	4	SRVY	5	SRVY	6	SRVY	7	SRVY	8	SRVY	9
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183.	15.7	183.	15.7	183.	15.7	183.	15.7	183.	15.8	183.	15.7	183.	15.7	183.	15.7
200.	9.5	196.	10.0	200.	9.6	200.	9.5	200.	9.7	197.	9.9	196.	10.0	195.	10.2
212.	10.1	206.	9.0	208.	9.1	212.	10.4	207.	9.0	207.	8.8	200.	9.4	200.	9.5
243.	6.7	213.	10.1	213.	10.1	221.	8.9	217.	10.7	214.	10.1	205.	8.8	207.	8.9
275.	4.9	228.	7.7	236.	6.5	238.	6.5	225.	8.4	225.	8.8	213.	10.5	213.	10.1
300.	3.0	246.	6.7	250.	5.5	250.	5.8	250.	5.7	250.	6.9	223.	6.6	225.	8.3
325.	.4	265.	6.9	275.	5.6	275.	3.6	275.	4.3	275.	6.2	250.	7.3	250.	7.3
350.	-1.3	267.	5.0	288.	5.7	300.	1.6	300.	3.3	300.	2.7	275.	4.3	275.	4.4
375.	-3.1	300.	3.7	300.	4.1	325.	2.0	325.	.4	325.	-.6	300.	1.9	300.	2.0
		325.	1.1	325.	2.0	350.	-.8	350.	-2.4	350.	-3.0	325.	.1	325.	.7
		350.	-1.1	350.	-.4	375.	-1.6	365.	-3.1			350.	-1.4	350.	-.1
		375.	-2.6	375.	-2.3	400.	-2.6					375.	-2.7	375.	-.8
														400.	-1.4
														425.	-2.4

LINE 14

DATE	710810	DATE	710901	DATE	711007	DATE	711215	DATE	720104	DATE	720209	DATE	720317	DATE	720417
SRVY	10	SRVY	11	SRVY	12	SRVY	13	SRVY	14	SRVY	15	SRVY	16	SRVY	17
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183.	15.5	183.	15.7	183.	15.6	183.	15.7	183.	15.6	183.	15.5	183.	14.7	183.	15.5
200.	9.3	200.	9.4	200.	9.5	197.	9.9	200.	9.5	200.	9.5	200.	8.7	200.	9.8
204.	8.7	205.	8.8	213.	10.1	206.	9.0	206.	9.0	215.	10.1	214.	9.3	206.	9.0
211.	10.3	215.	10.1	230.	7.9	215.	10.2	214.	10.1	225.	8.6	233.	6.9	214.	10.7
220.	8.1	227.	8.1	245.	7.5	226.	8.5	229.	8.1	250.	6.0	259.	3.2	237.	6.9
251.	7.1	252.	6.7	250.	5.5	250.	5.8	256.	5.2	275.	3.5	283.	1.3	260.	3.8
255.	6.6	277.	3.9	280.	3.0	275.	3.9	274.	2.5	300.	1.6	300.	.7	283.	2.3
257.	5.8	300.	2.0	300.	2.0	300.	2.4	300.	1.4	325.	.5	325.	-.3	300.	1.6
274.	5.1	325.	.8	325.	1.1	325.	1.3	325.	.8	350.	-.3	350.	-1.1	325.	.7
300.	2.2	350.	.2	350.	.4	350.	.5	350.	-.1	375.	-.9	375.	-1.7	350.	-.1
325.	.7	375.	-.6	375.	-.2	375.	.1	375.	-1.1	400.	-1.4	400.	-2.1	375.	-.2
350.	-.5	400.	-1.4	400.	-1.1	400.	-.6	400.	-1.6	425.	-1.7	425.	-2.4	400.	-.8
375.	-1.4	425.	-2.1	425.	-2.5	425.	-1.6	425.	-2.1	450.	-2.4	450.	-2.6	425.	-1.1
400.	-2.0	450.	-2.8			450.	-2.6	450.	-2.6			475.	-3.4	450.	-1.8
												500.	-4.1	475.	-2.6

LINE 14

DATE	720609	DATE	720625	DATE	720805	DATE	720929	DATE	721211	DATE	730116	DATE	730215	DATE	730316
SRVY	18	SRVY	19	SRVY	20	SRVY	21	SRVY	22	SRVY	23	SRVY	24	SRVY	25
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183.	15.5	183.	15.5	183.	15.5	183.	15.4	183.	15.5	183.	15.6	183.	15.4	183.	15.5
197.	10.2	200.	9.5	200.	9.6	201.	9.3	200.	9.7	185.	14.8	200.	9.6	187.	14.2
207.	9.0	212.	10.5	213.	11.1	215.	11.0	213.	10.8	197.	10.0	214.	10.8	200.	10.2
215.	10.6	224.	8.9	232.	7.3	233.	7.1	227.	8.4	200.	9.5	231.	7.9	207.	8.7
220.	8.7	233.	6.7	255.	5.6	257.	4.1	250.	6.1	213.	11.1	254.	6.0	216.	10.8
235.	6.5	255.	5.5	278.	3.9	287.	6.4	275.	4.1	222.	9.5	277.	4.2	228.	9.0
247.	5.3	277.	4.1	300.	2.5	300.	4.2	300.	2.2	234.	7.3	300.	2.8	247.	7.1
254.	4.5	300.	3.1	325.	1.2	325.	1.6	325.	1.3	256.	5.4	325.	1.7	272.	5.2
273.	5.1	325.	2.3	350.	.2	350.	.5	350.	.7	283.	5.2	350.	.7	300.	2.9
300.	3.3	350.	.6	375.	.2	375.	-.1	375.	.4	300.	3.6	375.	.1	325.	1.7
325.	2.0	375.	-1.1	400.	-1.0	400.	-1.1	400.	-.2	325.	1.8	400.	-.6	350.	.9
350.	.7	400.	-3.0	425.	-2.0	425.	-2.8	425.	-.9	350.	.4	425.	-1.7	375.	.2
375.	-.3			450.	-3.1			450.	-1.5	375.	-.2	450.	-2.9	400.	-.6
400.	-1.2							475.	-2.3	400.	-.9			425.	-1.4
425.	-1.9							500.	-3.0	425.	-2.2			450.	-2.5
450.	-2.5									450.	-3.1				

LINE 14

DATE 730529	SRVY 26	DATE 730816	SRVY 27	DATE 730615	SRVY 28	DATE 730713	SRVY 29	DATE 730810	SRVY 30	DATE 731008	SRVY 31	DATE 731206	SRVY 32	DATE 740108	SRVY 33
183.	15.4	183.	15.4	183.	15.2	183.	15.3	183.	15.2	163.	15.4	183.	15.0	183.	15.1
200.	9.6	200.	9.9	200.	9.8	200.	9.9	200.	9.9	195.	10.9	185.	14.6	196.	10.0
207.	9.2	213.	11.1	212.	11.5	214.	11.0	216.	10.9	200.	9.8	200.	9.5	200.	9.5
215.	11.1	233.	7.6	228.	7.6	237.	7.1	233.	7.6	213.	11.2	211.	11.3	213.	11.0
240.	7.1	257.	4.3	244.	5.7	250.	6.2	250.	6.4	230.	7.9	236.	7.7	228.	8.5
260.	5.3	282.	2.4	269.	5.0	269.	6.1	275.	5.7	255.	5.8	261.	5.0	255.	5.3
281.	4.0	300.	1.7	300.	3.0	300.	2.8	300.	2.9	283.	3.7	286.	3.0	286.	2.1
300.	2.7	325.	.6	325.	-.1	325.	1.4	325.	-.3	300.	2.4	300.	2.1	300.	1.9
325.	1.3	350.	-.4	350.	-.7	350.	.6	350.	-2.0	325.	1.5	325.	.9	325.	.8
350.	.4	375.	-1.1	375.	-1.0	375.	-.2	375.	-2.0	350.	0.0	350.	0.0	350.	.1
375.	-.4	400.	-1.0	400.	-1.5	400.	-1.3	400.	-1.8	375.	-.8	375.	-1.0	375.	-.5
400.	-1.1	425.	-.7	425.	-1.6	425.	-2.1	425.	-2.5	400.	-1.6	400.	-1.8	400.	-.9
425.	-1.4	450.	-1.7	450.	-2.1	450.	-2.7			425.	-2.6	425.	-2.5	425.	-1.7
450.	-2.5	475.	-2.6	475.	-2.8									450.	-2.6

LINE 14

DATE 740205	SRVY 34	DATE 740305	SRVY 35	DATE 740402	SRVY 36	DATE 740531	SRVY 37	DATE 740816	SRVY 38	DATE 741001	SRVY 39	DATE 741204	SRVY 40
183.	15.4	183.	14.9	183.	15.1	163.	15.0	183.	15.1	183.	15.2	183.	15.0
200.	9.6	200.	9.5	200.	9.6	200.	10.0	200.	9.8	197.	10.1	196.	9.9
211.	11.4	219.	10.8	214.	11.8	216.	11.7	214.	11.6	200.	10.0	200.	9.7
215.	11.1	245.	6.1	238.	6.6	229.	9.1	237.	7.1	215.	11.6	211.	11.6
237.	7.5	273.	3.3	262.	4.7	250.	5.7	260.	5.4	243.	6.9	236.	7.3
247.	5.9	300.	1.7	285.	2.6	275.	3.9	280.	4.8	250.	6.6	261.	3.9
258.	5.5	325.	.7	300.	1.8	300.	2.4	300.	3.4	275.	6.1	286.	1.8
283.	2.6	350.	-.3	325.	.9	325.	1.4	325.	1.0	300.	3.6	300.	1.5
300.	1.9	375.	-1.0	330.	.1	350.	.8	350.	.8	325.	1.0	325.	.7
325.	1.1	400.	-1.5	375.	-.5	375.	.2	375.	.3	350.	.6	350.	-.5
350.	.5	425.	-2.0	400.	-.8	400.	-.3	400.	-.4	375.	.5	375.	-1.3
375.	-.2	450.	-2.0	425.	-1.3	425.	-.7	425.	-1.2	400.	-.1	400.	-.5
400.	-.6	475.	-2.6	450.	-1.8	450.	-.4	450.	-2.2	425.	-.9	425.	-.7
425.	-1.3			475.	-3.0	475.	-1.0	475.	-3.1	450.	-1.9	450.	-1.3
450.	-2.2					500.	-2.0			475.	-3.0	475.	-2.8
467.	-2.6					525.	-2.8						

LINE 15

DATE	701116	DATE	701215	DATE	710118	DATE	710210	DATE	710310	DATE	710409	DATE	710511	DATE	710608
SRVY	2	SRVY	3	SRVY	4	SRVY	5	SRVY	6	SRVY	7	SRVY	8	SRVY	9
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153.	14.0	153.	14.5	153.	14.6	153.	14.5	153.	14.5	153.	14.1	153.	14.2	153.	14.3
164.	11.4	163.	11.6	168.	11.0	168.	10.8	163.	11.3	167.	10.8	175.	9.9	163.	11.1
195.	9.1	175.	9.8	196.	9.2	175.	10.0	175.	10.0	175.	9.4	195.	9.0	178.	9.7
200.	10.4	196.	9.2	210.	10.5	192.	9.1	194.	9.2	190.	9.0	200.	10.3	195.	9.0
210.	10.8	200.	10.4	215.	6.0	207.	10.8	200.	10.5	200.	10.7	208.	10.7	200.	10.2
211.	7.9	211.	10.5	225.	5.1	215.	6.1	208.	10.6	205.	7.8	211.	8.0	209.	10.5
240.	5.4	213.	7.9	250.	5.6	225.	5.8	213.	7.5	225.	6.0	225.	6.4	211.	8.1
259.	5.2	248.	7.2	266.	5.9	243.	5.1	225.	6.0	250.	4.1	250.	3.6	225.	6.4
282.	2.2	277.	4.7	278.	3.6	250.	4.4	250.	3.5	275.	1.5	275.	2.0	250.	4.1
300.	.3	300.	1.8	300.	1.2	275.	2.4	275.	2.4	300.	-.5	300.	.9	275.	2.5
325.	-1.0	325.	-.8	325.	-.3	300.	.8	300.	1.0	325.	-.8	325.	-.3	300.	1.5
350.	-2.1	350.	-2.4	350.	-1.4	325.	-.2	325.	-.7	350.	-1.3	350.	-1.2	325.	.7
375.	-3.3	375.	-3.3	375.	-2.3	350.	-1.0	350.	-2.1	375.	-1.9	375.	-1.2	350.	-.1
						375.	-1.8	375.	-2.9	400.	-1.9	400.	-1.6	375.	-1.2
						400.	-1.4			425.	-2.7	425.	-2.6	400.	-2.4
						425.	-2.0								
						450.	-2.8								

LINE 15

DATE	710810	DATE	710901	DATE	711007	DATE	711215	DATE	720108	DATE	720209	DATE	720317	DATE	720417
SRVY	10	SRVY	11	SRVY	12	SRVY	13	SRVY	14	SRVY	15	SRVY	16	SRVY	17
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153.	14.1	153.	14.1	153.	14.1	153.	14.1	153.	14.2	153.	14.0	153.	14.0	153.	14.2
166.	10.7	178.	9.6	178.	10.1	173.	9.6	166.	10.8	162.	11.4	163.	11.1	165.	11.1
178.	9.5	195.	9.1	190.	9.0	196.	9.1	191.	9.3	187.	9.5	186.	9.1	180.	9.9
190.	9.2	206.	11.0	205.	10.7	204.	10.6	204.	10.6	196.	9.3	203.	10.6	194.	8.5
200.	10.4	215.	7.7	212.	8.4	209.	6.5	209.	6.5	208.	10.7	207.	7.1	200.	10.7
206.	10.9	240.	6.7	229.	7.6	234.	3.9	234.	4.3	210.	6.5	236.	3.4	203.	10.6
213.	7.8	261.	5.3	230.	6.6	259.	2.7	241.	3.8	235.	4.4	252.	1.8	205.	7.7
230.	6.3	280.	5.1	255.	3.6	284.	1.6	266.	2.2	260.	2.7	282.	1.0	225.	4.3
255.	6.2	300.	2.0	280.	2.5	300.	1.2	291.	1.3	285.	1.2	300.	.3	250.	2.3
280.	2.9	320.	-1.1	300.	1.7	325.	1.0	300.	1.1	300.	.6	325.	-.3	275.	1.6
300.	.2	345.	-1.0	325.	.5	350.	-.2	325.	.5	325.	-.1	350.	-.4	300.	.8
325.	-.2	370.	-1.5	350.	-.7	375.	-1.3	350.	-.3	350.	-.9	375.	-.8	325.	0.0
350.	-.7	400.	-2.1	375.	-1.8	400.	-2.6	375.	-1.2	375.	-1.4	400.	-1.5	350.	-1.1
375.	-1.4	425.	-2.7	400.	-3.1			400.	-1.9	400.	-2.0	425.	-2.5	375.	-1.7
400.	-2.5							425.	-2.6	425.	-2.6	450.	-3.6	400.	-1.8
														425.	-2.0
														450.	-2.4

LINE 15

DATE 720809		DATE 720625		DATE 720805		DATE 720929		DATE 721211		DATE 730116		DATE 730215		DATE 730316	
SRVY	18	SRVY	19	SRVY	20	SRVY	21	SRVY	22	SRVY	23	SRVY	24	SRVY	25
153.	14.0	153.	14.0	152.	14.0	152.	14.0	153.	13.9	153.	14.1	153.	14.1	153.	14.1
164.	11.4	162.	11.5	164.	11.3	165.	10.9	165.	11.0	173.	10.2	164.	11.4	179.	9.7
194.	9.0	193.	9.0	190.	9.0	192.	9.1	175.	9.8	200.	11.0	190.	9.1	195.	9.3
204.	10.5	204.	10.6	200.	10.7	202.	10.7	194.	9.1	205.	9.1	208.	10.8	200.	10.5
205.	8.3	205.	8.4	203.	8.6	206.	8.4	200.	10.8	230.	5.4	211.	7.6	211.	7.4
208.	7.9	226.	5.6	225.	5.7	239.	5.5	208.	8.3	255.	3.6	234.	5.3	235.	5.7
209.	6.8	250.	3.3	250.	3.2	250.	6.0	225.	6.0	270.	2.4	260.	3.5	261.	3.7
235.	4.2	275.	.5	275.	2.1	275.	3.4	250.	3.7	300.	1.3	281.	2.4	284.	1.9
255.	3.7	300.	-1.8	300.	1.3	300.	1.5	275.	1.9	325.	.3	300.	1.6	300.	1.3
270.	1.3	325.	-2.1	325.	0.0	325.	.2	300.	1.2	350.	.1	325.	.9	325.	.6
300.	.1	350.	-1.6	350.	-1.5	350.	-.4	325.	.6	375.	-.6	350.	.4	350.	-.2
325.	-.2	375.	-1.7	375.	-2.8	375.	-1.3	350.	.1	400.	-1.5	375.	-.3	375.	-.7
350.	-.4	400.	-2.0			400.	-2.6	375.	-.8	425.	-2.9	400.	-1.4	400.	-1.6
375.	-1.2	425.	-2.6					400.	-1.9			425.	-2.6	425.	-2.6
400.	-1.6							425.	-2.9						
425.	-2.1														
450.	-2.7														

LINE 15

DATE 730329		DATE 730416		DATE 730615		DATE 730713		DATE 730810		DATE 731008		DATE 731206		DATE 740108	
SRVY	26	SRVY	27	SRVY	28	SRVY	29	SRVY	30	SRVY	31	SRVY	32	SRVY	33
153.	14.1	153.	14.1	153.	14.2	153.	14.2	153.	14.0	153.	14.1	153.	14.3	153.	14.1
164.	11.5	174.	10.0	171.	10.3	171.	10.3	167.	10.8	174.	10.2	169.	10.9	174.	10.0
194.	9.2	196.	8.9	196.	9.8	188.	9.5	195.	9.2	194.	9.3	187.	9.1	195.	9.5
204.	10.8	200.	11.0	200.	10.6	200.	11.0	200.	10.7	200.	10.9	200.	11.1	200.	11.4
208.	8.5	221.	5.6	209.	7.3	213.	7.5	212.	7.3	205.	8.6	215.	8.0	208.	9.0
225.	6.3	245.	3.4	229.	5.2	225.	5.5	225.	5.5	234.	5.2	235.	6.6	225.	6.6
250.	4.4	271.	1.9	244.	3.3	250.	4.0	250.	4.1	264.	5.5	260.	3.8	250.	4.1
275.	2.6	300.	1.1	275.	1.3	275.	3.3	275.	2.8	292.	1.7	285.	1.9	275.	2.0
300.	1.3	325.	-.1	300.	1.1	300.	1.2	300.	1.2	300.	-.5	300.	1.2	300.	.8
325.	.8	350.	-.7	325.	-.1	325.	0.0	325.	-.2	325.	-.7	325.	.2	325.	.3
350.	-.5	375.	-1.1	350.	0.0	350.	-1.0	350.	-1.4	350.	-1.1	350.	-.6	350.	-.6
375.	-.8	400.	-1.2	375.	-.7	375.	-2.0	375.	-1.9	375.	-1.7	375.	-1.6	375.	-1.3
400.	-1.7	425.	-1.8	400.	-1.6	400.	-2.8	400.	-2.6	400.	-1.6	400.	-2.5	400.	-2.4
415.	-2.2	450.	-2.8	425.	-2.8					425.	-2.0				
425.	-2.5									450.	-3.3				

LINE 15

DATE	740205	DATE	740305	DATE	740402	DATE	740531	DATE	740816	DATE	741001	DATE	741204
SRVY	34	SRVY	35	SRVY	36	SRVY	37	SRVY	38	SRVY	39	SRVY	40
153.	14.2	153.	14.2	153.	14.1	153.	14.2	153.	14.2	153.	14.2	153.	14.2
169.	10.8	175.	9.9	171.	10.7	171.	10.6	175.	10.1	172.	10.1	164.	11.3
195.	9.3	200.	10.9	192.	9.2	194.	9.3	195.	9.5	193.	9.5	193.	9.6
200.	11.1	216.	7.1	200.	11.1	200.	11.3	200.	11.5	200.	11.6	200.	11.3
205.	9.0	241.	4.5	218.	6.7	218.	5.8	212.	6.1	211.	7.2	206.	7.2
210.	7.6	268.	2.5	225.	5.6	245.	3.3	237.	4.6	225.	6.0	221.	4.1
230.	5.7	300.	1.0	250.	3.2	270.	1.8	262.	2.6	250.	4.0	250.	2.4
255.	3.4	325.	0.0	275.	1.7	300.	.5	287.	1.3	275.	1.7	275.	1.6
280.	1.6	350.	-.5	300.	.8	325.	.3	300.	.9	300.	1.2	300.	.9
300.	1.1	375.	-.8	325.	.2	350.	-.5	325.	.2	325.	.4	325.	-.1
325.	.5	400.	-1.0	350.	-.2	375.	-1.3	350.	-.5	350.	0.0	350.	-1.1
350.	0.0	425.	-2.2	375.	-.7	400.	-.7	375.	-1.0	375.	-.2	375.	-1.6
375.	-.8			400.	-1.4	425.	-1.3	400.	-1.5	400.	-.9	400.	-1.3
400.	-1.9			425.	-2.5	450.	-2.9	425.	-2.0	425.	-1.8	425.	-1.0
425.	-2.5							450.	-2.7	450.	-2.5	450.	-2.1
								475.	-3.3				

LINE 16

DATE	701110	DATE	701215	DATE	710118	DATE	710210	DATE	710310	DATE	710409	DATE	710511	DATE	710608
SRVY	2	SRVY	3	SRVY	4	SRVY	5	SRVY	6	SRVY	7	SRVY	8	SRVY	9
139.	15.3	139.	15.4	139.	15.4	139.	15.5	139.	15.4	139.	15.3	139.	15.5	139.	15.3
150.	9.6	155.	9.5	159.	9.2	154.	9.8	155.	10.0	154.	10.0	143.	15.0	146.	14.6
175.	8.8	174.	8.8	175.	8.8	175.	8.8	170.	9.4	173.	8.7	150.	11.6	155.	9.8
178.	7.7	177.	7.8	200.	5.8	200.	6.1	175.	8.8	179.	7.6	157.	9.4	175.	8.5
206.	6.4	200.	6.9	217.	4.8	225.	4.1	200.	5.4	200.	5.3	175.	8.5	182.	7.2
225.	4.5	218.	7.0	241.	5.7	250.	2.2	225.	3.3	225.	3.6	200.	6.5	200.	5.6
250.	3.5	247.	5.0	269.	3.8	275.	.9	250.	1.7	250.	3.1	225.	4.1	225.	5.2
275.	1.2	275.	1.7	300.	.5	300.	.3	275.	.8	275.	1.5	250.	2.7	250.	5.3
300.	-.7	300.	-.3	325.	-1.8	325.	-.3	300.	.1	300.	.7	275.	2.6	261.	5.5
325.	-2.3	325.	-2.1	350.	-2.6	350.	-.8	325.	-.6	325.	.2	300.	1.5	275.	3.8
350.	-3.0	350.	-3.1			375.	-1.5	350.	-1.2	350.	-.8	325.	.8	300.	1.3
						400.	-2.5	375.	-1.8	375.	-2.1	350.	-.4	325.	-.3
								400.	-2.1	400.	-3.1	375.	-1.7	350.	-1.6
								425.	-2.9			400.	-3.0	375.	-2.8

LINE 16

DATE	710810	DATE	710901	DATE	711007	DATE	711215	DATE	720108	DATE	720209	DATE	720317	DATE	720817
SRVY	10	SRVY	11	SRVY	12	SRVY	13	SRVY	14	SRVY	15	SRVY	16	SRVY	17
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139.	15.3	139.	15.4	139.	15.3	139.	15.3	139.	15.4	139.	15.4	139.	15.4	139.	16.1
145.	14.1	157.	9.6	158.	9.5	155.	9.7	153.	10.0	157.	9.4	155.	9.6	144.	14.7
157.	9.3	162.	9.6	170.	9.2	170.	9.4	178.	8.1	170.	9.5	180.	8.0	156.	9.7
162.	10.0	179.	8.2	181.	7.6	188.	6.7	186.	7.1	195.	5.9	200.	5.2	167.	9.9
185.	8.3	198.	5.9	200.	6.9	200.	4.9	200.	4.2	200.	5.6	225.	2.6	195.	5.7
195.	5.9	225.	6.8	212.	7.2	225.	4.4	225.	2.0	225.	3.6	250.	1.6	200.	5.0
200.	5.6	233.	4.7	237.	4.0	250.	1.9	250.	1.0	250.	1.7	275.	.5	225.	2.8
208.	5.3	258.	4.5	263.	2.4	275.	1.0	275.	.4	275.	.6	300.	-.6	250.	1.7
233.	6.8	283.	1.9	287.	.9	300.	.2	300.	-.5	300.	-.2	325.	-.8	275.	.6
250.	7.1	300.	-.5	300.	.2	325.	-1.0	325.	-1.0	325.	-1.0	350.	-.7	300.	-.1
275.	2.9	314.	-2.5	325.	-1.1	350.	-2.3	350.	-1.2	350.	-1.5	375.	-1.1	325.	-.1
300.	-.1	339.	-2.6	350.	-2.6	375.	-3.4	375.	-1.7	375.	-2.2	400.	-1.6	350.	-.5
325.	-1.3	364.	-2.4					400.	-2.4	400.	-2.5	425.	-2.6	375.	-1.1
350.	-2.4	389.	-2.4											400.	-1.7
		400.	-2.7											425.	-2.0
														450.	-2.5

LINE 16

DATE	720609	DATE	720625	DATE	720805	DATE	720929	DATE	721211	DATE	730116	DATE	730215	DATE	730316
SRVY	18	SRVY	19	SRVY	20	SRVY	21	SRVY	22	SRVY	23	SRVY	24	SRVY	25
----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------
139.	15.5	139.	15.4	139.	15.5	139.	15.5	139.	15.4	139.	15.4	139.	15.5	139.	15.5
140.	15.0	156.	9.8	143.	14.7	157.	9.9	158.	10.0	143.	15.1	157.	9.7	155.	9.9
150.	9.8	172.	9.1	156.	10.0	164.	10.4	167.	10.0	156.	9.7	167.	10.2	162.	10.5
170.	8.9	175.	7.8	161.	10.2	172.	7.2	187.	6.8	169.	10.4	176.	8.4	180.	7.7
181.	6.8	200.	5.1	170.	9.6	180.	6.1	200.	5.8	178.	8.3	200.	6.1	200.	6.2
200.	5.3	225.	3.0	177.	7.9	225.	6.5	225.	3.8	200.	5.5	225.	4.1	225.	4.2
219.	5.9	250.	1.4	200.	5.3	233.	6.5	250.	2.2	225.	5.2	250.	2.5	250.	2.6
234.	4.0	275.	.5	225.	4.0	257.	2.7	275.	1.4	250.	2.9	275.	1.5	275.	1.5
259.	1.4	300.	-.3	250.	1.5	276.	1.3	300.	1.0	275.	1.2	300.	.8	300.	.6
280.	1.1	325.	-.9	275.	1.0	300.	.4	325.	0.0	300.	.3	325.	.2	325.	0.0
300.	-2.0	350.	-1.3	300.	.4	325.	-.3	350.	-.6	325.	-.4	350.	-.6	350.	-.7
325.	-.7	375.	-1.9	325.	0.0	350.	-1.6	375.	-1.7	350.	-.7	375.	-1.9	375.	-1.6
350.	-1.4	400.	-2.9	350.	-1.0	375.	-3.5	400.	-2.7	375.	-1.9	400.	-3.2	400.	-2.6
375.	-2.0			375.	-2.1					400.	-3.2				
400.	-2.7			400.	-3.5										

LINE 16

DATE 730329 SRVY 26		DATE 730416 SRVY 27		DATE 730615 SRVY 28		DATE 730713 SRVY 29		DATE 730810 SRVY 30		DATE 731008 SRVY 31		DATE 731206 SRVY 32		DATE 740108 SRVY 33	
139.	15.5	139.	15.5	139.	15.5	139.	15.5	139.	15.4	139.	15.5	139.	15.3	139.	15.5
144.	14.8	157.	9.9	155.	10.3	156.	9.9	155.	10.2	158.	10.2	140.	15.1	154.	10.3
157.	9.8	165.	10.6	164.	11.0	164.	10.5	162.	11.1	164.	11.2	150.	9.9	161.	11.2
164.	10.6	190.	6.3	171.	7.4	186.	6.8	189.	6.5	182.	6.8	164.	11.1	180.	8.4
173.	9.4	200.	4.8	200.	5.2	200.	5.8	200.	5.9	200.	5.0	182.	6.6	200.	6.9
200.	6.0	225.	3.3	225.	3.8	225.	5.8	225.	6.4	225.	3.1	200.	6.4	225.	4.8
225.	4.5	250.	1.3	250.	2.5	250.	5.7	250.	4.2	250.	1.9	218.	6.1	250.	2.9
250.	2.7	275.	.3	275.	2.4	275.	2.9	275.	2.9	278.	1.0	243.	3.1	275.	1.5
275.	1.5	304.	.2	300.	1.2	300.	-.2	300.	.9	300.	.2	266.	.7	300.	.8
300.	.9	325.	.6	325.	-.3	325.	-1.3	325.	-1.0	325.	-.6	300.	-2.2	325.	-1.2
325.	-.2	350.	-.3	350.	-1.4	350.	-1.7	350.	-2.0	350.	-1.1	325.	-3.4	350.	-1.6
350.	-.8	375.	-2.3	375.	-2.5	375.	-2.8	375.	-2.7	375.	-1.3			375.	-2.9
375.	-1.5									400.	-1.8				
400.	-2.4									425.	-2.5				

LINE 16

DATE 740205 SRVY 34		DATE 740305 SRVY 35		DATE 740402 SRVY 36		DATE 740531 SRVY 37		DATE 740816 SRVY 38		DATE 741001 SRVY 39		DATE 741205 SRVY 40	
139.	15.4	139.	15.5	139.	15.5	139.	15.4	139.	15.4	139.	15.4	139.	15.5
142.	15.1	146.	14.7	158.	9.9	145.	14.7	156.	10.3	154.	10.4	155.	10.5
154.	10.3	169.	9.9	165.	11.1	157.	10.4	167.	11.6	161.	11.8	162.	11.9
162.	11.8	179.	11.5	194.	6.6	165.	11.6	200.	6.3	187.	7.6	176.	9.1
181.	7.5	180.	8.8	200.	6.2	186.	7.8	225.	5.4	200.	6.8	200.	5.4
200.	6.2	200.	5.4	225.	4.6	200.	6.4	250.	2.9	225.	5.1	225.	2.4
225.	5.7	225.	3.6	250.	2.8	225.	4.2	275.	1.3	250.	3.3	250.	1.6
250.	2.1	250.	2.3	275.	1.7	250.	2.7	300.	.6	275.	1.8	275.	.6
275.	.7	275.	.8	300.	1.0	275.	1.7	325.	-.1	300.	1.5	300.	-.3
300.	.2	300.	.9	325.	.0	300.	1.0	350.	-.7	325.	.8	325.	.7
325.	-.4	325.	.6	350.	-.4	335.	1.0	375.	-1.5	350.	-.2	350.	.2
350.	-1.0	350.	-.3	375.	-1.8	350.	.6	400.	-2.6	375.	-1.5	375.	-.8
375.	-2.2	375.	-1.2	400.	-3.2	375.	-.5			400.	-2.6	400.	-2.8
400.	-2.9	400.	-2.3			400.	-1.9						
						425.	-3.5						

LINE 17

DATE 701116	SRVY 2	DATE 701216	SRVY 3	DATE 710118	SRVY 4	DATE 710210	SRVY 5	DATE 710310	SRVY 6	DATE 710409	SRVY 7	DATE 710511	SRVY 8	DATE 710608	SRVY 9
123.	17.1	124.	17.1	124.	17.2	124.	17.1	124.	17.0	124.	16.9	124.	17.0	124.	16.9
137.	14.3	137.	13.5	148.	10.2	139.	14.2	139.	14.2	139.	14.0	139.	14.0	140.	13.7
148.	9.9	146.	10.2	162.	9.0	148.	10.3	144.	10.2	148.	10.1	148.	10.1	147.	10.1
162.	9.0	162.	9.0	179.	6.3	162.	9.3	150.	10.2	160.	10.4	161.	10.5	156.	10.0
166.	7.6	168.	7.5	194.	5.2	175.	6.6	161.	10.3	166.	7.8	177.	7.9	165.	8.1
188.	6.2	188.	6.4	225.	5.7	200.	6.3	166.	8.4	175.	6.7	200.	5.5	185.	6.3
200.	5.6	218.	7.1	250.	4.1	225.	4.0	175.	7.0	200.	5.0	225.	4.6	208.	5.9
230.	4.9	243.	4.0	275.	2.0	250.	1.8	200.	4.3	225.	4.9	242.	4.4	225.	6.0
255.	3.4	268.	1.2	300.	-1.1	275.	.1	225.	3.2	243.	5.1	258.	2.6	250.	3.6
280.	1.1	292.	-.3	325.	-2.6	300.	-.7	250.	1.4	250.	4.0	275.	1.1	275.	1.0
300.	-1.0	315.	-1.5			325.	-1.7	275.	.3	275.	1.6	300.	-.6	300.	-.9
315.	-1.6	335.	-2.7			350.	-3.0	300.	-.6	300.	-.2	325.	-2.2	325.	-2.7
								325.	-1.2	325.	-1.8				
								350.	-2.2	350.	-3.5				
								375.	-3.8						

LINE 17

DATE 710810	SRVY 10	DATE 710901	SRVY 11	DATE 711007	SRVY 12	DATE 711215	SRVY 13	DATE 720104	SRVY 14	DATE 720209	SRVY 15	DATE 720317	SRVY 16	DATE 720417	SRVY 17
124.	16.6	124.	16.8	124.	16.7	124.	16.9	124.	16.9	123.	16.6	123.	16.7	124.	16.9
128.	14.3	148.	10.1	139.	14.2	139.	13.9	139.	13.9	138.	13.8	137.	14.3	138.	14.4
151.	10.6	157.	10.1	148.	10.0	148.	10.1	166.	10.4	147.	10.1	147.	11.2	147.	10.4
164.	10.0	171.	7.3	158.	10.3	158.	10.2	158.	10.3	155.	10.4	157.	10.3	157.	10.7
165.	8.0	200.	5.9	165.	8.4	162.	7.6	162.	7.6	165.	7.0	160.	7.6	173.	5.8
188.	6.2	225.	4.9	180.	7.5	187.	4.3	187.	3.9	191.	4.3	181.	5.0	200.	3.0
195.	6.6	250.	2.7	194.	7.6	200.	3.6	200.	2.6	200.	3.7	200.	3.1	225.	1.8
200.	6.7	275.	-.3	195.	7.1	225.	2.2	225.	1.3	225.	2.0	225.	1.7	250.	.9
212.	7.0	300.	-3.2	200.	6.2	250.	1.3	250.	.8	250.	.8	250.	.8	275.	.1
224.	6.7	325.	-3.4	225.	3.1	275.	.5	275.	.5	275.	0.0	275.	.1	300.	-.8
250.	2.7	362.	-3.3	250.	.7	300.	-.6	300.	-.2	300.	-.6	300.	0.0	325.	-.9
279.	.2	368.	-2.5	275.	-1.0	325.	-1.9	325.	-1.3	325.	-1.5	325.	-.8	350.	-1.8
300.	-1.2	375.	-2.4	300.	-2.6	350.	-3.1	350.	-2.2	350.	-1.9	350.	-1.9	375.	-2.8
325.	-2.0	400.	-2.7					375.	-3.1	375.	-2.5	375.	-3.1		

LINE 17

DATE	720609	DATE	720625	DATE	720805	DATE	720929	DATE	721211	DATE	730116	DATE	730215	DATE	730316
SRVY	18	SRVY	19	SRVY	20	SRVY	21	SRVY	22	SRVY	23	SRVY	24	SRVY	25
124.	16.8	123.	16.8	123.	16.9	123.	16.8	124.	16.8	124.	16.8	123.	16.8	123.	16.7
130.	14.5	138.	14.1	138.	14.1	137.	14.5	139.	14.4	139.	14.3	138.	14.1	136.	14.5
145.	10.5	145.	10.6	146.	10.3	147.	10.3	149.	10.3	148.	10.4	148.	10.2	146.	10.3
157.	10.0	155.	10.5	153.	10.9	150.	10.6	157.	10.5	156.	10.5	156.	10.5	155.	10.4
160.	7.6	159.	7.8	158.	8.1	153.	7.5	158.	7.6	161.	8.4	159.	8.4	160.	8.0
182.	5.8	183.	5.6	173.	6.2	172.	6.3	180.	5.9	200.	4.8	174.	6.8	187.	5.8
200.	4.7	200.	4.2	200.	7.0	200.	7.3	200.	5.3	225.	2.6	200.	4.1	200.	4.3
225.	5.5	225.	2.4	225.	4.5	215.	6.9	225.	3.9	250.	1.1	225.	2.4	225.	2.4
250.	2.8	250.	1.3	250.	2.8	242.	2.8	250.	1.6	275.	.4	250.	1.2	250.	1.5
275.	1.6	275.	.7	275.	.7	277.	.9	275.	.4	300.	-.4	275.	.5	275.	.5
300.	.5	300.	.5	300.	-1.1	300.	-.2	300.	0.0	325.	-1.7	300.	-.4	300.	-.3
325.	-.7	325.	-.3	325.	-2.6	325.	-1.1	325.	-1.1	350.	-2.3	325.	-1.7	325.	-1.4
350.	-1.6	350.	-1.5			350.	-1.9	350.	-1.9	375.	-3.2	350.	-3.0	350.	-2.7
375.	-2.7	375.	-2.6			375.	-2.6	375.	-2.6						

LINE 17

DATE	730329	DATE	730416	DATE	730615	DATE	730713	DATE	730810	DATE	731008	DATE	740106	DATE	740205
SRVY	26	SRVY	27	SRVY	28	SRVY	29	SRVY	30	SRVY	31	SRVY	33	SRVY	34
124.	16.8	123.	16.9	123.	16.7	123.	16.9	123.	16.8	123.	16.8	123.	16.6	123.	16.8
139.	14.2	138.	14.0	140.	13.1	148.	10.3	138.	14.4	139.	13.4	126.	16.5	137.	14.4
148.	10.4	148.	10.4	148.	10.4	155.	10.8	148.	10.3	146.	10.5	138.	14.2	146.	10.4
150.	10.5	158.	10.8	158.	10.5	165.	6.5	153.	10.6	154.	10.6	147.	10.4	153.	10.8
180.	9.0	168.	6.9	162.	7.1	200.	5.5	165.	6.7	160.	8.1	154.	10.5	160.	8.4
200.	4.1	186.	3.9	189.	4.2	225.	5.1	200.	6.0	200.	4.5	159.	8.2	183.	5.9
225.	2.2	200.	3.0	200.	3.4	250.	2.8	225.	5.3	225.	2.5	188.	6.1	200.	5.2
250.	.4	225.	1.0	225.	2.5	275.	.6	250.	3.0	250.	1.4	200.	4.9	225.	2.4
275.	0.0	250.	.2	250.	2.3	300.	-.8	275.	1.0	275.	1.2	225.	2.8	250.	1.6
300.	-.7	275.	.5	275.	1.3	325.	-1.9	300.	-.4	300.	.3	250.	1.4	275.	.6
325.	-1.2	300.	0.0	300.	-.1	350.	-2.6	325.	-1.8	325.	-.3	275.	.4	300.	-.4
350.	-2.1	325.	-.8	325.	-1.6			350.	-2.6	350.	-.8	300.	-.7	325.	-2.0
375.	-3.4	350.	-2.2	350.	-2.6					375.	-1.4	325.	-2.1	350.	-2.4
		375.	-3.2							400.	-2.4	350.	-3.3		
										425.	-3.6				

LINE 17

DATE	740305	DATE	740402	DATE	740531	DATE	740816	DATE	741001	DATE	741205
SRVY	35	SRVY	36	SRVY	37	SRVY	38	SRVY	39	SRVY	40
----	------	----	------	----	------	----	------	----	------	----	------
123.	16.8	123.	16.8	123.	16.8	124.	16.8	124.	16.8	125.	16.7
140.	14.1	138.	14.2	140.	14.2	139.	14.3	139.	14.1	137.	14.3
147.	10.5	150.	10.8	149.	10.3	149.	10.4	148.	10.5	146.	10.5
158.	10.5	156.	10.5	156.	10.8	156.	10.7	157.	10.7	152.	10.6
165.	7.0	174.	5.9	165.	7.5	161.	8.1	162.	8.1	159.	7.8
200.	3.7	200.	4.3	187.	4.8	186.	6.2	175.	7.4	171.	4.9
225.	2.3	225.	2.9	200.	3.5	200.	5.2	191.	6.5	200.	2.3
250.	1.3	250.	1.7	225.	2.0	225.	2.7	200.	4.9	225.	1.2
275.	.3	275.	.9	250.	1.2	250.	.9	225.	2.4	250.	.3
300.	-.7	300.	.1	275.	.3	275.	0.0	250.	1.1	275.	.5
325.	-.9	325.	-1.2	300.	.1	300.	-.7	275.	.5	300.	-.4
350.	-1.7	350.	-2.5	325.	-.5	325.	-1.4	300.	.3	325.	-2.1
375.	-2.5			350.	-1.5	350.	-2.0	325.	-.4		
				375.	-2.4	375.	-2.5	350.	-1.3		
								375.	-2.6		

LINE 18

DATE	701110	DATE	701216	DATE	710118	DATE	710210	DATE	710310	DATE	710409	DATE	710511	DATE	710608
SRVY	2	SRVY	3	SRVY	4	SRVY	5	SRVY	6	SRVY	7	SRVY	8	SRVY	9
----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------
170.	14.5	170.	14.6	170.	14.5	170.	14.6	170.	14.8	170.	14.8	170.	14.6	170.	14.8
183.	12.2	182.	12.6	182.	12.4	183.	12.1	175.	14.1	180.	13.2	175.	14.0	181.	12.5
194.	8.4	193.	8.5	200.	7.0	202.	6.7	196.	7.7	191.	7.7	185.	11.3	192.	8.0
200.	7.7	200.	7.7	225.	4.8	225.	5.5	200.	7.0	200.	7.2	193.	7.8	200.	7.2
225.	6.1	230.	7.0	247.	5.9	250.	3.2	225.	4.1	225.	5.1	200.	7.2	225.	5.6
260.	4.7	256.	5.6	275.	2.1	275.	1.5	250.	3.9	250.	4.0	228.	5.7	250.	3.3
290.	2.5	278.	2.7	300.	1.6	300.	.6	260.	3.9	275.	2.4	250.	4.4	275.	1.4
310.	.4	300.	1.0	325.	-.8	325.	-.5	275.	1.6	300.	.2	275.	2.1	300.	-.8
335.	-1.7	325.	-1.0	352.	-1.8	350.	-1.6	281.	1.0	325.	-1.7	300.	-.6	325.	-3.0
		340.	-1.9			375.	-2.8	300.	.8	350.	-3.2	325.	-2.6		
		365.	-3.4					325.	-.8						
								350.	-2.4						
								370.	-4.0						

LINE 18

DATE	710810	DATE	710901	DATE	711007	DATE	711215	DATE	720104	DATE	720209	DATE	720320	DATE	720417
SRVY	10	SRVY	11	SRVY	12	SRVY	13	SRVY	14	SRVY	15	SRVY	16	SRVY	17
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170.	14.7	170.	14.8	170.	14.8	170.	14.7	170.	14.7	170.	14.7	170.	14.9	170.	14.8
191.	12.6	193.	8.0	179.	13.3	182.	12.1	182.	12.3	181.	12.5	182.	12.5	182.	12.5
194.	7.5	209.	7.2	192.	8.2	191.	6.9	193.	6.1	193.	6.4	191.	6.6	190.	6.2
200.	7.2	234.	4.4	218.	8.3	200.	5.2	200.	5.1	200.	6.0	200.	5.5	200.	4.7
225.	6.9	259.	2.8	219.	7.6	225.	3.3	225.	2.3	225.	3.9	225.	2.9	225.	2.3
233.	6.8	284.	1.0	234.	5.2	250.	1.9	250.	1.2	250.	1.9	250.	1.4	250.	1.2
250.	3.2	300.	-.3	259.	2.2	275.	.9	275.	.7	275.	.6	275.	.6	275.	.5
283.	.4	325.	-1.9	284.	-.1	300.	.6	300.	1.0	300.	-.2	300.	-.1	300.	-.1
300.	-1.1	350.	-3.7	300.	-1.4	325.	-.6	325.	-.8	325.	-1.1	325.	-.6	325.	-.7
325.	-2.6			325.	-2.9	350.	-2.0	350.	-1.7	350.	-1.7	350.	-1.5	350.	-1.1
350.	-3.7					375.	-3.2	375.	-2.4	375.	-2.4	375.	-2.1	375.	-1.9
								400.	-2.8			400.	-3.1	400.	-3.1

LINE 18

DATE	720609	DATE	720625	DATE	720805	DATE	720929	DATE	721211	DATE	730116	DATE	730215	DATE	730316
SRVY	18	SRVY	19	SRVY	20	SRVY	21	SRVY	22	SRVY	23	SRVY	24	SRVY	25
----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------
170.	15.1	170.	15.0	170.	14.9	170.	14.9	170.	14.9	170.	15.0	170.	14.9	170.	14.9
177.	14.0	176.	13.7	177.	14.0	177.	13.6	176.	13.9	175.	14.2	176.	13.9	176.	14.0
179.	9.0	185.	6.8	184.	6.9	185.	7.1	183.	8.3	181.	8.8	181.	8.7	181.	8.9
181.	7.1	200.	4.8	200.	6.9	200.	7.2	200.	6.1	200.	6.6	193.	7.1	200.	6.1
200.	5.3	225.	2.4	212.	6.3	225.	5.2	225.	5.2	225.	6.3	200.	6.2	211.	6.0
225.	2.4	234.	1.8	237.	3.0	250.	2.7	250.	2.7	250.	2.3	225.	3.6	225.	4.5
250.	1.0	251.	1.9	258.	1.9	275.	1.1	275.	.7	275.	.5	250.	2.2	250.	2.4
275.	1.1	275.	1.8	280.	.8	300.	.2	300.	-.6	300.	-.5	275.	1.3	275.	1.1
300.	.7	300.	.9	300.	-.6	325.	-.8	325.	-2.0	325.	-1.9	300.	.1	300.	.2
325.	.1	325.	-.4	325.	-2.0	350.	-1.6	350.	-3.0	350.	-2.1	325.	-1.4	325.	-1.2
350.	-.6	350.	-1.3	350.	-3.3	375.	-2.5			375.	-3.1	350.	-2.9	350.	-2.7
375.	-1.4	375.	-2.4												
400.	-2.0														
425.	-2.6														

LINE 18

DATE 730329		DATE 730416		DATE 730615		DATE 730713		DATE 730810		DATE 731009		DATE 731206		DATE 740108	
SRVY	26	SRVY	27	SRVY	28	SRVY	29	SRVY	30	SRVY	31	SRVY	32	SRVY	33
----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------
170.	15.0	170.	15.0	170.	15.0	170.	15.0	170.	14.9	170.	15.1	170.	11.2	170.	11.5
177.	14.1	177.	14.0	175.	14.6	176.	14.8	173.	14.4	175.	14.3	176.	7.0	175.	7.9
183.	8.0	185.	6.7	181.	6.0	187.	6.0	187.	6.1	183.	6.6	189.	4.5	200.	7.3
200.	6.1	200.	4.2	200.	4.3	200.	4.7	200.	4.6	200.	4.5	200.	3.7	225.	2.6
225.	3.8	225.	2.6	225.	2.4	225.	2.9	225.	4.0	225.	2.7	225.	2.3	250.	1.4
250.	2.0	250.	.7	250.	1.2	250.	1.8	250.	3.2	255.	1.2	250.	1.2	275.	.8
275.	.4	275.	.2	275.	.7	275.	1.1	275.	1.6	275.	.7	275.	.2	300.	-1.0
300.	-.8	300.	-.3	300.	-.3	300.	.2	300.	-1.5	300.	.2	300.	1.0	325.	-1.0
325.	-1.3	325.	-.6	325.	-1.0	325.	-.6	325.	-2.3	325.	-.7	325.	-2.7	350.	-2.1
350.	-1.9	350.	-1.6	350.	-1.7	350.	-1.6	350.	-2.5	350.	-1.5			375.	-3.0
375.	-2.9	375.	-2.8	375.	-2.2	375.	-2.3			375.	-2.8				
				400.	-2.8	400.	-2.8								

LINE 18

DATE 740205		DATE 740305		DATE 740402		DATE 740531		DATE 740816		DATE 741001		DATE 741205	
SRVY	34	SRVY	35	SRVY	36	SRVY	37	SRVY	38	SRVY	39	SRVY	40
----	------	----	------	----	------	----	------	----	------	----	------	----	------
170.	11.9	170.	12.0	170.	9.5	170.	10.0	130.	7.8	165.	12.8	167.	12.9
176.	6.0	177.	7.4	180.	6.5	180.	7.0	150.	13.3	168.	13.3	175.	8.2
192.	7.8	200.	5.9	200.	6.3	204.	7.0	168.	14.0	178.	7.5	200.	4.5
200.	7.2	225.	4.9	221.	6.6	230.	4.0	177.	7.4	200.	7.3	225.	2.1
206.	7.8	250.	3.4	250.	2.1	255.	2.3	200.	6.1	217.	6.5	250.	1.4
225.	5.2	275.	.4	275.	1.0	283.	1.2	225.	5.9	225.	4.8	275.	.6
250.	3.3	300.	-1.8	300.	-.1	300.	.8	250.	3.0	250.	2.1	300.	-.2
275.	1.2	325.	-1.7	325.	-1.2	325.	-.4	275.	.7	275.	1.2	325.	-.6
300.	.2	350.	-1.7	350.	-2.1	350.	-1.7	300.	-.4	300.	.4	350.	-1.0
325.	-.8	375.	-2.0	375.	-2.2	375.	-2.5	325.	-1.4	325.	-.4	375.	-2.2
350.	-1.7	400.	-2.4	400.	-2.5	400.	-2.7	350.	-1.8	350.	-1.3		
375.	-2.2	425.	-3.0	423.	-3.0	425.	-2.6	375.	-1.8	375.	-2.0		
400.	-2.7							400.	-2.2	400.	-2.5		
								425.	-2.8				

LINE 19

DATE 701118		DATE 701216		DATE 710118		DATE 710210		DATE 710310		DATE 710409		DATE 710511		DATE 710608	
SRVY	2	SRVY	3	SRVY	4	SRVY	5	SRVY	6	SRVY	7	SRVY	8	SRVY	9
----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------
158.	17.5	158.	17.7	158.	17.6	158.	17.4	.58.	17.3	158.	17.3	158.	17.4	158.	17.5
185.	9.2	186.	9.5	166.	16.0	188.	9.2	188.	9.0	168.	15.3	166.	15.8	170.	14.2
200.	9.7	209.	9.6	188.	9.0	193.	9.8	192.	9.9	188.	8.9	186.	9.1	187.	8.9
208.	6.8	213.	6.8	200.	9.4	210.	9.2	200.	9.3	193.	9.7	192.	10.0	192.	9.8
235.	6.0	246.	6.7	209.	9.6	217.	6.9	210.	9.1	200.	9.2	200.	9.2	200.	9.5
265.	5.2	273.	4.8	215.	7.1	225.	6.3	215.	7.5	210.	9.2	209.	8.8	209.	9.1
280.	4.7	300.	2.5	225.	6.0	250.	5.6	225.	6.4	212.	8.1	225.	7.8	214.	8.2
300.	2.9	325.	.4	250.	4.9	275.	3.9	250.	4.2	225.	7.9	236.	7.4	225.	7.9
325.	-.1	350.	-1.8	275.	5.8	300.	1.7	275.	3.3	250.	6.2	250.	5.5	250.	6.0
350.	-1.8	375.	-2.6	292.	3.8	325.	.4	300.	3.0	275.	4.9	275.	4.9	275.	3.8
				300.	2.6	350.	-.9	325.	.6	300.	3.2	300.	3.2	300.	1.9
				325.	1.4	375.	-2.1	350.	-1.2	325.	1.2	325.	.2	325.	.3
				350.	-.8	400.	-3.1	375.	-2.4	350.	-.9	350.	-1.7	350.	-.6
				370.	-2.4			390.	-2.9	375.	-2.1	375.	-3.0	375.	-1.3
										400.	-3.2			400.	-2.2
														425.	-2.9

LINE 19

DATE 710810		DATE 710901		DATE 711007		DATE 711215		DATE 720104		DATE 720209		DATE 720320		DATE 720417	
SRVY	10	SRVY	11	SRVY	12	SRVY	13	SRVY	14	SRVY	15	SRVY	16	SRVY	17
----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------
158.	17.2	158.	17.4	158.	17.4	158.	17.3	158.	17.3	158.	17.2	158.	17.3	158.	18.3
167.	15.3	187.	9.0	188.	8.8	164.	16.0	165.	15.8	166.	15.3	186.	9.5	187.	9.3
182.	11.2	193.	9.8	195.	10.0	180.	11.4	188.	9.1	187.	9.1	200.	10.1	195.	10.3
189.	8.9	200.	9.5	212.	8.6	188.	9.1	193.	10.0	193.	10.0	225.	8.4	200.	9.9
194.	10.0	212.	8.6	222.	7.2	195.	10.1	200.	9.7	200.	9.7	250.	6.1	225.	8.4
200.	9.5	226.	7.3	223.	6.7	225.	8.6	225.	8.5	225.	8.5	275.	3.4	239.	7.6
211.	8.9	232.	6.1	250.	7.2	236.	7.6	244.	6.7	250.	6.5	300.	1.8	262.	4.8
220.	7.5	257.	5.2	260.	7.1	261.	4.6	269.	3.6	267.	6.7	325.	.6	283.	2.9
230.	5.6	281.	4.5	285.	3.9	286.	2.6	294.	1.6	293.	3.3	350.	-.1	300.	2.0
261.	3.4	300.	2.4	300.	2.2	300.	1.9	300.	1.5	300.	2.7	375.	-1.0	325.	1.0
280.	2.1	325.	-.1	325.	-.4	325.	.9	325.	1.1	325.	.9	400.	-1.8	350.	.1
300.	1.0	350.	-1.8	350.	-2.7	350.	.1	350.	-.1	350.	-.6	425.	-2.6	375.	-1.1
325.	.4	375.	-2.5			375.	-1.1	375.	-1.2	375.	-1.5			400.	-1.8
350.	-.8	400.	-2.8			400.	-2.4	400.	-2.0	400.	-2.0			425.	-2.6
375.	-1.9							425.	-2.4	419.	-2.5				
400.	-2.1														

LINE 19

DATE 720609 SRVY 18		DATE 720625 SRVY 19		DATE 720805 SRVY 20		DATE 720929 SRVY 21		DATE 721211 SRVY 22		DATE 730116 SRVY 23		DATE 730215 SRVY 24		DATE 730316 SRVY 25	
158.	17.3	158.	17.2	158.	17.3	158.	17.3	158.	17.3	158.	17.2	158.	17.3	158.	17.3
169.	15.0	167.	15.2	161.	17.1	161.	9.3	170.	14.2	188.	9.3	161.	17.1	161.	17.1
181.	10.4	186.	9.3	164.	15.9	194.	10.1	188.	9.3	200.	9.8	187.	9.3	181.	10.1
188.	9.3	193.	10.1	187.	9.4	221.	8.9	200.	10.4	225.	7.8	194.	10.3	185.	10.4
194.	10.3	216.	8.8	192.	10.4	237.	6.9	225.	7.7	250.	6.5	206.	9.6	200.	9.9
200.	10.0	235.	5.9	200.	10.1	258.	6.7	250.	7.4	275.	4.0	235.	7.6	225.	7.9
217.	6.9	257.	3.8	217.	8.9	274.	5.9	275.	5.4	300.	4.7	255.	7.6	250.	7.7
220.	7.2	277.	2.4	230.	7.1	300.	5.5	300.	5.4	325.	3.3	269.	7.7	263.	7.6
250.	5.0	300.	1.1	254.	6.9	325.	3.0	325.	3.2	350.	1.2	285.	5.5	290.	3.9
275.	2.7	325.	.6	280.	3.9	350.	1.4	350.	-.3	375.	.3	300.	3.7	300.	3.1
291.	.9	350.	.4	300.	2.2	375.	.1	375.	-.9	400.	-.7	325.	1.9	325.	1.5
296.	.5	375.	-.1	325.	1.3	400.	-.7	400.	-2.2	425.	-1.6	350.	.7	350.	1.2
300.	.7	400.	-.2	350.	.3	425.	-1.9	425.	-2.8	450.	-2.3	375.	-.3	375.	.9
325.	.7	425.	-1.8	375.	-1.0					475.	-3.1	400.	-1.1	400.	.4
350.	.2	450.	-2.7	400.	-1.9							425.	-1.9	425.	-.3
375.	-.5			425.	-2.6							450.	-2.6	450.	-.9
400.	-1.3													475.	-1.7
425.	-2.0													500.	-2.7
450.	-2.0														

LINE 19

DATE 730329 SRVY 26		DATE 730416 SRVY 27		DATE 730615 SRVY 28		DATE 730713 SRVY 29		DATE 730810 SRVY 30		DATE 731009 SRVY 31		DATE 731206 SRVY 32		DATE 740108 SRVY 33	
158.	17.4	158.	17.3	158.	17.1	158.	17.2	158.	17.2	158.	17.3	150.	17.1	158.	17.2
161.	17.2	162.	17.0	180.	9.3	162.	17.1	167.	16.4	187.	9.3	155.	17.0	162.	16.8
186.	9.7	189.	9.2	197.	10.8	186.	9.5	190.	9.1	195.	10.7	186.	9.7	187.	9.5
193.	10.4	200.	10.3	200.	10.6	198.	10.7	200.	10.7	200.	10.6	195.	10.7	200.	10.4
200.	10.3	225.	8.1	225.	8.6	225.	8.1	225.	8.4	225.	8.3	200.	8.4	225.	8.3
212.	9.9	250.	7.5	250.	7.6	250.	7.3	250.	7.6	252.	7.7	225.	7.7	250.	7.7
219.	8.8	275.	5.5	275.	5.8	275.	5.8	275.	5.9	275.	6.4	250.	7.2	275.	6.9
242.	7.9	300.	4.1	300.	5.9	300.	6.1	300.	6.2	300.	5.1	275.	5.5	300.	4.0
256.	7.7	325.	4.0	325.	5.2	325.	6.3	325.	6.9	325.	2.7	300.	3.3	325.	2.3
279.	5.7	350.	2.9	350.	3.1	350.	3.2	333.	4.5	351.	1.7	325.	1.8	350.	1.3
300.	4.6	375.	.6	375.	1.8	375.	1.3	350.	2.6	375.	.9	350.	.8	375.	.6
325.	3.1	400.	.1	400.	.6	400.	.3	375.	.9	400.	-.2	375.	.1	400.	-.4
350.	1.8	425.	.3	425.	-1.0	425.	-.9	400.	-.1	425.	-.7	400.	-.6	425.	-1.0
375.	1.3	450.	-.2	450.	-2.0	450.	-2.6	425.	-.9	450.	-1.3	425.	-1.9	450.	-1.7
400.	.6	475.	-.9	475.	-2.8			450.	-1.8	475.	-1.7	450.	-3.0	475.	-2.1
425.	.3	500.	-1.7					475.	-2.7	500.	-1.8			500.	-2.7
450.	-.3	525.	-2.7							525.	-3.3				
475.	-1.2														
500.	-1.5														
525.	-2.5														

LINE 19

DATE 740205	
SRVY	34
----	------
158.	17.2
161.	16.9
181.	11.7
190.	9.2
195.	10.7
200.	10.3
225.	8.3
250.	7.8
265.	7.0
275.	5.5
300.	4.3
325.	2.2
350.	1.5
375.	.7
400.	.2
425.	-.4
450.	-.9
475.	-1.3
500.	-1.8
525.	-2.5

DATE 740305	
SRVY	35
----	------
158.	17.3
161.	17.1
191.	9.6
200.	10.5
225.	8.7
250.	7.7
275.	6.0
300.	4.5
325.	2.7
350.	1.7
375.	.9
400.	.7
425.	-.2
450.	-.8
475.	-1.9
500.	-2.5

DATE 740402	
SRVY	36
----	------
158.	17.2
191.	9.2
200.	10.7
225.	8.5
250.	8.0
275.	5.8
300.	4.6
325.	3.1
350.	1.9
375.	1.1
400.	.4
425.	-.6
450.	-1.1
475.	-1.6
500.	-2.2
525.	-2.7

DATE 740531	
SRVY	37
----	------
158.	17.3
168.	15.8
191.	9.5
200.	11.5
225.	8.9
250.	7.9
275.	6.4
300.	5.4
325.	4.0
350.	2.4
375.	1.5
400.	.9
425.	-.2
450.	-1.1
475.	-1.5
500.	-2.1
525.	-2.5

DATE 740816	
SRVY	38
----	------
158.	17.1
167.	15.8
188.	9.2
200.	10.8
225.	8.5
250.	7.7
275.	5.9
300.	6.1
310.	6.2
325.	3.9
350.	1.3
375.	.4
400.	-.5
425.	-.6
450.	-1.0
475.	-1.5
500.	-2.1
525.	-2.8

DATE 741001	
SRVY	39
----	------
158.	17.2
168.	15.7
188.	9.6
200.	10.9
211.	10.0
216.	9.0
225.	8.7
250.	7.8
275.	6.6
300.	6.9
311.	6.7
325.	5.2
350.	2.9
375.	.8
400.	.5
425.	-.1
450.	-.6
475.	-.9
500.	-1.4
525.	-2.1
550.	-2.8

DATE 741205	
SRVY	40
----	------
158.	17.2
186.	9.4
200.	10.8
225.	8.2
250.	7.6
275.	6.2
300.	4.5
325.	2.9
350.	2.2
375.	1.6
400.	.6
425.	-.7
450.	-1.7
475.	-2.2

LINE 20

DATE	701118	DATE	701216	DATE	710118	DATE	710210	DATE	710310	DATE	710409	DATE	710511	DATE	710608
SRVY	2	SRVY	3	SRVY	4	SRVY	5	SRVY	6	SRVY	7	SRVY	8	SRVY	9
113.	9.8	113.	9.6	113.	9.6	113.	9.8	113.	10.2	113.	10.1	113.	9.9	113.	10.0
123.	8.0	125.	8.0	125.	8.0	125.	8.0	125.	8.0	125.	8.0	125.	7.9	125.	7.9
147.	7.3	144.	7.7	150.	7.1	150.	7.8	150.	7.6	150.	7.6	150.	7.4	150.	7.3
175.	5.1	175.	5.1	175.	4.8	175.	5.0	175.	5.0	175.	4.7	175.	4.7	165.	5.8
200.	3.7	200.	3.8	200.	3.8	194.	4.1	200.	4.2	192.	4.4	200.	4.6	171.	4.9
225.	2.4	225.	2.8	225.	4.3	200.	4.0	225.	4.8	200.	4.7	225.	4.9	175.	4.6
250.	1.9	235.	3.2	250.	4.3	225.	4.3	250.	4.9	225.	5.0	250.	4.9	200.	4.5
275.	1.7	244.	4.3	275.	4.0	250.	4.6	275.	4.2	250.	5.1	275.	5.0	225.	4.9
300.	1.5	268.	4.8	300.	3.9	275.	4.8	300.	3.3	275.	5.0	300.	5.3	250.	5.0
325.	1.2	300.	3.1	325.	4.2	300.	3.9	325.	2.7	300.	4.3	325.	5.0	275.	5.2
350.	.8	325.	2.1	350.	3.2	325.	2.7	350.	2.5	325.	3.6	350.	3.8	300.	5.6
375.	.3	350.	1.4	375.	1.9	350.	1.7	375.	1.4	350.	3.1	375.	3.3	325.	6.0
400.	.2	375.	.6	400.	1.0	375.	.9	400.	1.5	375.	2.8	400.	2.1	339.	5.1
425.	-.9	400.	-.3	425.	-.3	400.	.4	425.	1.4	400.	2.7	425.	.9	355.	5.3
450.	-1.5	425.	-.9	450.	-1.9	425.	-.1	450.	.6	425.	1.8	450.	-.1	375.	3.3
475.	-2.5	450.	-1.5			450.	-.4	475.	-.2	450.	.8	475.	-.9	400.	1.0
500.	-3.2	475.	-2.0			475.	-.9	500.	-1.1	475.	-.2	500.	-1.4	425.	-.5
		500.	-2.3			500.	-1.4	525.	-2.0	500.	-1.0	525.	-2.1	450.	-1.2
		525.	-2.4			525.	-1.9	550.	-3.0	525.	-1.5	550.	-2.5	475.	-1.6
		550.	-2.7			550.	-2.3			550.	-1.9			500.	-2.2
						575.	-2.6			575.	-1.9			525.	-2.7
										600.	-2.0				
										625.	-2.4				
										650.	-3.0				

LINE 20

DATE	710810	DATE	710901	DATE	711007	DATE	711215	DATE	720104	DATE	720209	DATE	720320	DATE	720417
SRVY	10	SRVY	11	SRVY	12	SRVY	13	SRVY	14	SRVY	15	SRVY	16	SRVY	17
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113.	9.8	113.	9.9	113.	10.3	113.	10.3	113.	10.4	113.	10.0	113.	10.4	113.	10.4
125.	8.2	125.	8.2	121.	8.5	122.	8.7	121.	8.7	123.	8.7	131.	6.2	131.	8.2
150.	7.4	146.	7.7	146.	7.8	143.	8.3	146.	8.2	150.	8.0	134.	6.3	134.	6.7
165.	5.9	174.	4.9	167.	5.8	160.	7.5	163.	7.0	175.	5.2	166.	3.5	163.	4.2
190.	4.6	200.	4.6	178.	4.7	185.	4.6	168.	5.9	200.	2.6	186.	2.4	183.	3.3
200.	4.6	225.	4.8	189.	4.9	200.	3.3	193.	3.8	225.	.3	200.	1.9	200.	2.7
225.	4.9	250.	5.0	202.	6.2	225.	1.6	200.	3.3	250.	-1.2	225.	1.2	225.	2.0
250.	5.0	275.	5.4	225.	6.6	250.	1.1	225.	2.0	275.	-1.7	250.	.6	250.	1.7
275.	5.4	300.	5.7	238.	6.9	275.	0.0	250.	.9	300.	-2.3	275.	.1	275.	1.2
300.	5.8	315.	5.4	256.	4.4	300.	-1.1	275.	-.4			300.	-.5	300.	.5
325.	5.8	350.	2.2	281.	2.6	325.	-2.1	300.	-1.4			325.	-.1	325.	-.3
350.	4.0	375.	1.2	300.	2.1	350.	-2.9	325.	-2.3			350.	-1.4	350.	-1.4
375.	1.6	400.	.3	325.	1.2			350.	-3.5			375.	-1.4	375.	-2.6
400.	.6	425.	-.9	350.	.2							400.	-1.9		
425.	-.7	450.	-2.2	375.	-.7							425.	-2.7		
450.	-1.9	475.	-2.9	400.	-1.7										
475.	-2.7			425.	-2.6										

LINE 20

DATE	720609	DATE	720625	DATE	720805	DATE	720929	DATE	721211	DATE	730116	DATE	730215	DATE	730316
SRVY	18	SRVY	19	SRVY	20	SRVY	21	SRVY	22	SRVY	23	SRVY	24	SRVY	25
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113.	10.4	113.	10.5	113.	10.5	113.	10.5	113.	10.6	113.	10.5	113.	10.4	113.	10.5
120.	8.6	125.	8.6	118.	9.2	119.	9.1	116.	9.9	117.	7.5	115.	10.0	116.	8.0
128.	6.4	126.	7.3	121.	5.8	120.	7.0	119.	6.8	142.	5.6	116.	8.0	132.	6.6
152.	5.1	151.	4.1	148.	3.9	138.	5.9	145.	3.4	173.	5.9	123.	7.3	156.	3.3
179.	3.8	178.	2.1	171.	2.8	150.	2.9	175.	2.2	200.	2.8	140.	5.3	168.	1.6
200.	2.8	200.	1.6	200.	1.7	175.	1.2	200.	1.9	225.	1.1	163.	3.7	200.	1.4
225.	2.2	225.	1.0	225.	.4	200.	.5	225.	1.6	250.	.2	188.	2.7	225.	.9
250.	1.1	250.	.3	250.	-1.4	220.	-.8	250.	.2	275.	-.6	200.	2.3	250.	-.1
275.	-.2	275.	-1.0	275.	-3.2	250.	-2.5	275.	-1.3	300.	-1.6	225.	1.6	275.	-1.5
300.	-1.5	300.	-2.2					300.	-2.7	325.	-3.1	250.	.9	300.	-3.1
325.	-2.1	325.	-3.4									275.	-.1		
350.	-3.1											300.	-1.4		
												325.	-2.9		

LINE 20

DATE	730329	DATE	730416	DATE	730615	DATE	730713	DATE	730810	DATE	731009	DATE	731206	DATE	740108
SRVY	26	SRVY	27	SRVY	28	SRVY	29	SRVY	30	SRVY	31	SRVY	32	SRVY	33
113.	8.1	113.	10.5	113.	10.4	113.	10.3	113.	10.3	113.	10.4	113.	10.5	113.	10.4
116.	10.1	116.	7.9	118.	7.2	120.	7.2	115.	8.1	118.	8.0	119.	8.0	116.	8.4
117.	7.9	138.	5.2	143.	5.4	138.	5.6	138.	5.8	138.	6.7	141.	7.0	146.	6.4
140.	5.6	176.	3.6	164.	3.6	163.	5.0	163.	4.9	152.	6.8	166.	4.6	175.	4.9
163.	4.2	200.	2.8	191.	1.9	188.	3.9	186.	4.1	185.	4.5	200.	3.6	200.	5.0
181.	2.8	225.	1.8	200.	1.9	200.	3.3	200.	3.7	200.	3.4	225.	2.7	210.	5.2
200.	1.7	250.	.3	225.	1.0	225.	2.1	225.	2.6	225.	1.7	250.	1.9	250.	2.9
225.	.7	275.	-1.0	250.	.7	250.	1.0	250.	1.0	255.	1.1	275.	1.2	275.	2.3
250.	-.3	300.	-2.3	275.	-.3	275.	-.5	275.	-.3	275.	.6	300.	.7	300.	1.0
275.	-1.6	325.	-3.9	300.	-1.7	300.	-2.4	300.	-2.2	300.	-.3	325.	.3	325.	-.6
300.	-2.6			325.	-4.2	325.	-3.8	325.	-3.9	325.	-1.2	350.	-.6	350.	-2.0
										350.	-2.2	375.	-2.7	375.	-3.8
										375.	-3.9	400.	-3.6		

LINE 20

DATE	740205	DATE	740305	DATE	740402	DATE	740531	DATE	740816	DATE	741001	DATE	741205
SRVY	34	SRVY	35	SRVY	36	SRVY	37	SRVY	38	SRVY	39	SRVY	40
113.	10.5	117.	8.7	113.	10.5	113.	10.6	113.	10.7	113.	11.2	113.	11.9
116.	8.5	145.	6.9	121.	7.9	124.	8.2	128.	8.0	124.	8.3	119.	9.2
141.	6.3	171.	6.0	147.	6.6	150.	6.6	150.	6.5	133.	8.3	147.	6.7
167.	5.5	200.	5.6	175.	5.6	175.	5.7	175.	5.8	141.	6.9	170.	6.3
192.	4.9	225.	5.0	200.	5.7	200.	6.2	200.	5.8	150.	6.4	200.	5.8
200.	4.7	250.	3.6	219.	5.6	225.	4.5	225.	5.0	175.	5.8	225.	5.2
225.	5.0	275.	1.8	246.	3.2	250.	3.5	250.	5.4	200.	5.7	250.	4.8
241.	4.7	300.	.1	273.	1.3	275.	2.5	275.	3.9	225.	5.7	275.	4.2
263.	2.7	325.	-2.0	300.	-.4	300.	1.7	300.	2.4	250.	5.8	300.	3.5
285.	1.1	350.	-2.6	325.	-1.4	325.	1.1	325.	1.3	275.	4.6	325.	2.4
300.	.3			350.	-2.4	350.	.7	350.	.9	300.	2.7	350.	1.9
325.	-1.5			375.	-1.4	375.	.5	375.	.7	325.	1.8	375.	1.3
350.	-2.8			400.	-.7	400.	.1	400.	.7	350.	1.7	400.	.8
				425.	-.9	425.	0.0	425.	.5	375.	1.5	425.	.3
				450.	-.7	450.	-.2	450.	0.0	400.	1.2	450.	0.0
				475.	-.8	475.	-.6	475.	-.5	425.	.9	475.	-.2
				500.	-1.3	500.	-1.0	500.	-1.0	450.	.6	500.	-.5
				525.	-2.4	525.	-1.5	525.	-1.5	475.	.3	525.	-.7
						550.	-2.0	550.	-2.0	500.	.2	550.	-1.2
						575.	-2.5	575.	-2.5	525.	-.6	575.	-1.7
										550.	-1.1	600.	-2.7
										575.	-1.6		
										600.	-2.7		

LINE 21

DATE	701118	DATE	701216	DATE	710118	DATE	710210	DATE	710310	DATE	710409	DATE	710511	DATE	710608
SRVY	2	SRVY	3	SRVY	4	SRVY	5	SRVY	6	SRVY	7	SRVY	8	SRVY	9
113.	17.2	118.	17.1	113.	17.3	113.	17.4	113.	17.3	113.	16.6	113.	17.2	111.	17.3
115.	17.0	127.	6.8	126.	6.3	125.	6.2	125.	7.6	117.	11.6	128.	6.9	125.	7.4
118.	11.6	134.	6.2	150.	4.3	150.	4.0	134.	5.7	129.	6.6	150.	5.2	150.	5.1
125.	6.6	169.	3.0	175.	2.4	175.	3.8	150.	5.0	150.	5.2	175.	4.1	175.	4.1
150.	4.5	195.	.1	200.	3.2	200.	3.5	175.	4.0	175.	4.1	200.	3.8	200.	4.6
175.	1.8	225.	-.8	225.	3.0	225.	3.0	200.	3.1	200.	3.6	225.	3.9	225.	3.9
200.	1.2	250.	-.7	250.	1.9	250.	2.3	225.	2.6	225.	3.1	250.	2.9	250.	4.6
225.	-.4	275.	.1	275.	1.2	275.	1.5	250.	2.2	250.	2.6	275.	2.1	275.	3.1
250.	-1.4	300.	-.2	300.	.1	300.	.9	275.	2.2	275.	1.7	300.	1.2	300.	1.2
275.	-1.6	325.	-.6	325.	-1.9	325.	.4	300.	1.4	300.	1.1	325.	.6	325.	-.4
300.	-1.1	350.	-1.9	347.	-2.1	350.	-.2	325.	.7	325.	.6	350.	-.5	350.	-2.2
325.	-.8	375.	-2.9			375.	-2.4	350.	.2	350.	0.0	375.	-2.3	375.	-4.4
350.	-1.1	400.	-3.9			384.	-4.4	375.	-1.2	375.	-1.2	395.	-3.8		
375.	-2.3							400.	-4.5	400.	-3.6				
398.	-3.9														

LINE 21

DATE	710610	DATE	710901	DATE	711007	DATE	711215	DATE	720104	DATE	720209	DATE	720417	DATE	720609
SRVY	10	SRVY	11	SRVY	12	SRVY	13	SRVY	14	SRVY	15	SRVY	17	SRVY	18
113.	14.1	113.	14.2	113.	14.7	113.	14.7	100.	14.6	100.	14.5	100.	14.5	112.	15.1
125.	7.8	134.	6.3	123.	8.7	130.	9.2	110.	17.7	109.	16.7	111.	16.6	131.	7.3
150.	5.1	164.	4.3	143.	5.6	155.	4.9	136.	6.2	140.	5.7	126.	7.7	157.	5.2
175.	4.5	184.	4.6	168.	4.3	173.	5.6	161.	4.6	165.	4.7	150.	5.2	184.	5.6
200.	4.8	200.	5.0	193.	5.1	200.	6.2	172.	5.4	190.	5.9	175.	5.4	200.	5.7
225.	5.6	225.	5.6	200.	5.4	225.	5.2	200.	6.1	200.	6.0	200.	5.3	225.	5.8
240.	5.8	242.	5.9	225.	5.8	250.	4.0	225.	5.1	225.	5.1	225.	5.2	250.	6.0
275.	2.8	267.	3.8	243.	5.3	275.	3.9	250.	5.2	250.	5.2	250.	5.5	275.	5.1
300.	.9	292.	2.7	260.	6.0	300.	4.0	274.	5.1	275.	5.6	275.	6.7	300.	3.7
325.	-1.1	300.	2.5	289.	5.7	313.	4.1	300.	3.3	300.	3.9	300.	5.5	325.	2.7
350.	-2.7	325.	1.5	300.	5.0	338.	2.3	325.	2.2	325.	2.1	325.	3.5	350.	1.6
		350.	-.1	325.	3.3	363.	.5	350.	.9	350.	.9	400.	1.9	375.	.1
		375.	-2.7	350.	1.5	388.	-1.8	375.	-.9	375.	-1.1	425.	.2	400.	-2.4
		394.	-3.9	375.	-.6	400.	-3.0	400.	-3.5	387.	-2.7	450.	-2.0	411.	-3.8
				400.	-3.7							475.	-3.1		

LINE 21

DATE	720625	DATE	720805	DATE	720929	DATE	721211	DATE	730116	DATE	730215	DATE	730310	DATE	730329
SRVY	19	SRVY	20	SRVY	21	SRVY	22	SRVY	23	SRVY	24	SRVY	25	SRVY	26
113.	10.4	113.	15.3	113.	15.1	113.	15.0	113.	15.0	113.	14.8	113.	14.8	113.	14.5
129.	7.7	123.	9.6	126.	8.8	149.	6.6	145.	7.2	121.	10.0	134.	6.6	120.	10.6
140.	5.5	141.	6.0	139.	6.1	180.	5.4	170.	5.2	134.	6.9	159.	5.2	141.	5.9
162.	4.8	172.	5.4	157.	5.3	200.	5.8	200.	5.7	150.	5.5	187.	5.7	166.	5.4
193.	5.5	200.	5.9	183.	5.5	225.	5.9	225.	6.0	174.	5.6	200.	5.9	182.	5.6
200.	5.7	225.	6.0	200.	5.6	250.	6.4	250.	6.5	200.	6.0	225.	6.3	200.	5.9
225.	5.8	250.	6.0	225.	5.5	275.	6.6	275.	6.3	225.	6.4	250.	6.5	225.	6.6
250.	6.1	275.	5.0	250.	5.9	300.	5.2	300.	4.7	250.	6.8	275.	5.9	250.	6.8
275.	4.0	298.	5.3	275.	5.6	325.	3.3	325.	4.7	262.	6.8	300.	5.0	275.	6.4
300.	3.0	325.	4.4	300.	6.5	350.	2.6	350.	3.2	275.	5.6	325.	4.3	300.	4.7
325.	2.0	350.	1.3	307.	6.4	375.	1.9	375.	1.9	300.	3.9	350.	2.9	325.	3.2
350.	1.1	375.	-1.1	325.	6.4	400.	.1	400.	.6	325.	2.9	375.	1.3	350.	2.0
375.	.6	400.	-3.1	350.	4.1	425.	-2.8	425.	-2.3	350.	2.0	400.	-.8	367.	1.4
400.	-1.2			375.	2.1			450.	-3.2	375.	1.2	418.	-3.2	379.	1.5
425.	-1.3			400.	.1					400.	-.1			400.	.8
430.	-3.2			425.	-2.4					417.	-4.1			425.	-2.6

LINE 21

DATE	730416	DATE	730615	DATE	730713	DATE	730810	DATE	731009	DATE	731206	DATE	740108	DATE	740205
SRVY	27	SRVY	28	SRVY	29	SRVY	30	SRVY	31	SRVY	32	SRVY	33	SRVY	34
113.	14.4	113.	14.0	113.	14.2	113.	14.1	113.	13.8	113.	14.0	113.	14.0	113.	14.2
138.	6.6	134.	7.6	134.	7.3	138.	8.2	129.	7.9	133.	7.9	124.	8.3	130.	8.4
168.	5.6	156.	6.0	163.	6.0	163.	5.9	158.	6.0	159.	5.9	150.	5.8	140.	6.3
200.	5.9	182.	5.9	189.	5.8	188.	5.7	183.	5.7	185.	5.7	175.	5.8	175.	5.6
225.	6.2	200.	5.9	200.	5.9	200.	5.8	200.	5.8	200.	5.8	200.	6.0	200.	5.6
250.	6.4	225.	6.1	225.	6.0	225.	6.2	225.	5.9	225.	6.1	231.	6.4	225.	5.9
275.	5.9	250.	6.1	250.	6.0	250.	5.9	250.	5.9	250.	6.5	250.	6.6	250.	6.4
300.	5.0	275.	5.8	275.	5.8	275.	5.8	275.	6.2	275.	6.5	275.	6.3	275.	6.4
325.	4.4	300.	5.5	300.	5.7	300.	6.8	300.	4.5	300.	5.5	300.	5.2	300.	5.7
350.	3.3	325.	5.3	325.	4.3	325.	5.8	325.	2.7	325.	4.7	325.	4.2	325.	4.7
375.	1.6	350.	3.0	350.	2.2	329.	5.8	350.	1.9	350.	2.8	350.	3.2	350.	4.3
400.	-1.4	375.	1.5	375.	.9	350.	3.3	375.	.6	375.	1.6	375.	1.9	375.	3.5
425.	-4.5	400.	-1.1	400.	-1.7	375.	1.5	400.	-1.9	400.	.3	400.	.3	400.	1.7
		425.	-3.3	425.	-4.1	400.	-3.5	425.	-3.3	425.	-2.2	425.	-2.5	425.	-.6
										448.	-3.3			450.	-3.5

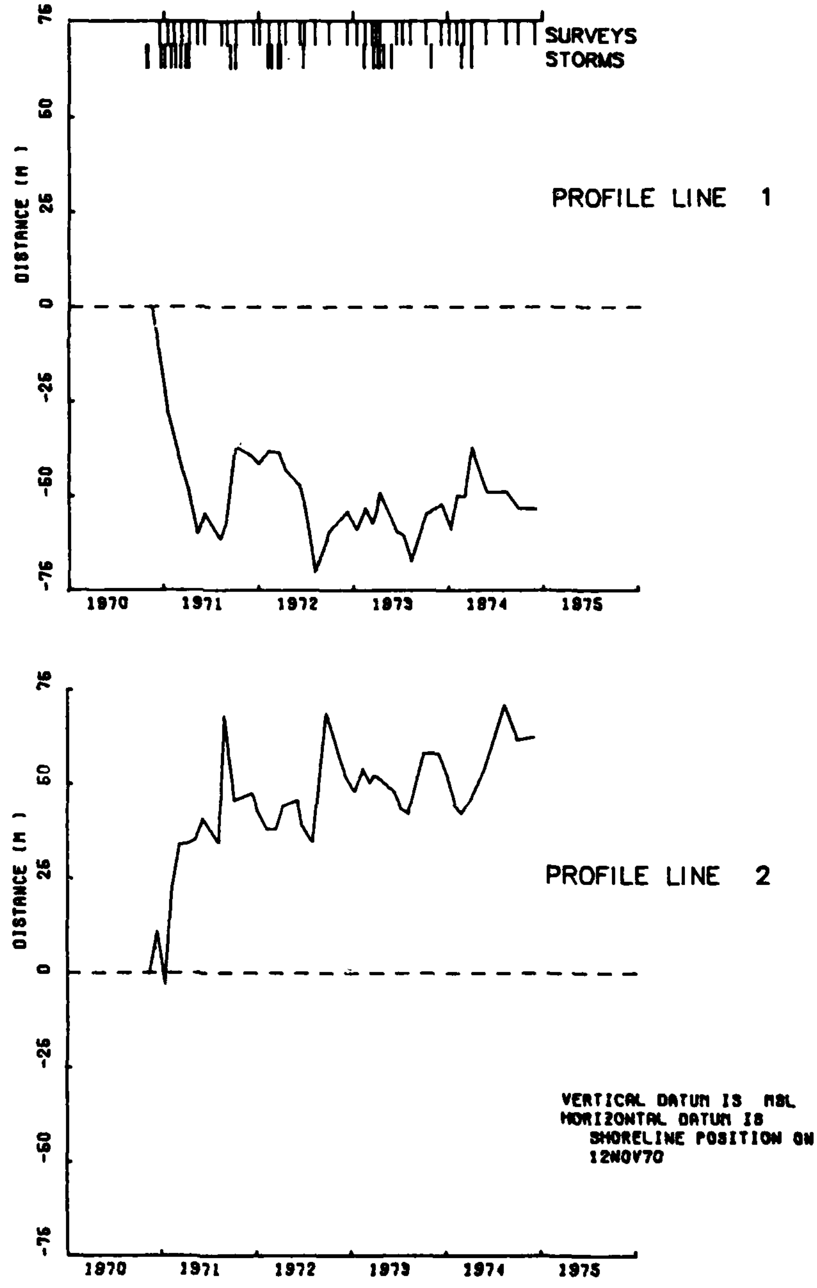
LINE 21

DATE 740305		DATE 740402		DATE 740531		DATE 740816		DATE 741001		DATE 741205	
SRVY	35	SRVY	36	SRVY	37	SRVY	38	SRVY	39	SRVY	40
113.	14.1	113.	14.1	113.	14.4	100.	17.1	100.	17.2	100.	17.3
131.	8.0	133.	8.4	147.	6.9	107.	17.8	107.	17.6	106.	17.8
161.	5.6	160.	5.7	176.	5.8	125.	9.8	114.	14.1	125.	10.4
200.	5.8	195.	6.0	200.	5.9	150.	6.8	125.	10.0	144.	7.3
225.	6.0	200.	5.8	225.	6.0	175.	5.8	150.	7.0	160.	6.0
250.	6.4	225.	6.0	250.	6.3	200.	5.9	158.	6.0	189.	5.7
275.	6.3	250.	6.3	275.	6.5	225.	5.9	175.	5.9	200.	5.8
300.	6.0	275.	6.6	300.	5.8	250.	6.1	200.	5.8	225.	6.0
325.	4.5	300.	6.0	325.	5.2	275.	6.4	225.	6.0	250.	6.1
350.	4.2	325.	5.0	350.	5.3	300.	5.6	250.	6.4	275.	6.3
375.	3.4	350.	4.9	375.	4.8	325.	5.2	275.	6.4	300.	5.5
400.	2.3	368.	5.0	400.	4.0	350.	5.2	300.	5.7	325.	5.4
425.	-.4	400.	2.4	425.	2.6	375.	4.7	325.	5.1	350.	5.1
450.	-4.8	425.	1.4	450.	1.9	400.	4.9	350.	5.3	375.	4.6
		450.	-3.5	470.	.6	425.	3.1	375.	5.5	400.	3.8
				478.	-2.8	450.	2.3	400.	4.2	425.	2.9
						475.	.6	425.	2.6	450.	2.1
						481.	.1	450.	2.1	475.	1.3
						487.	-2.7	475.	1.2	500.	-2.0
								489.	-1.6		
								497.	-2.4		

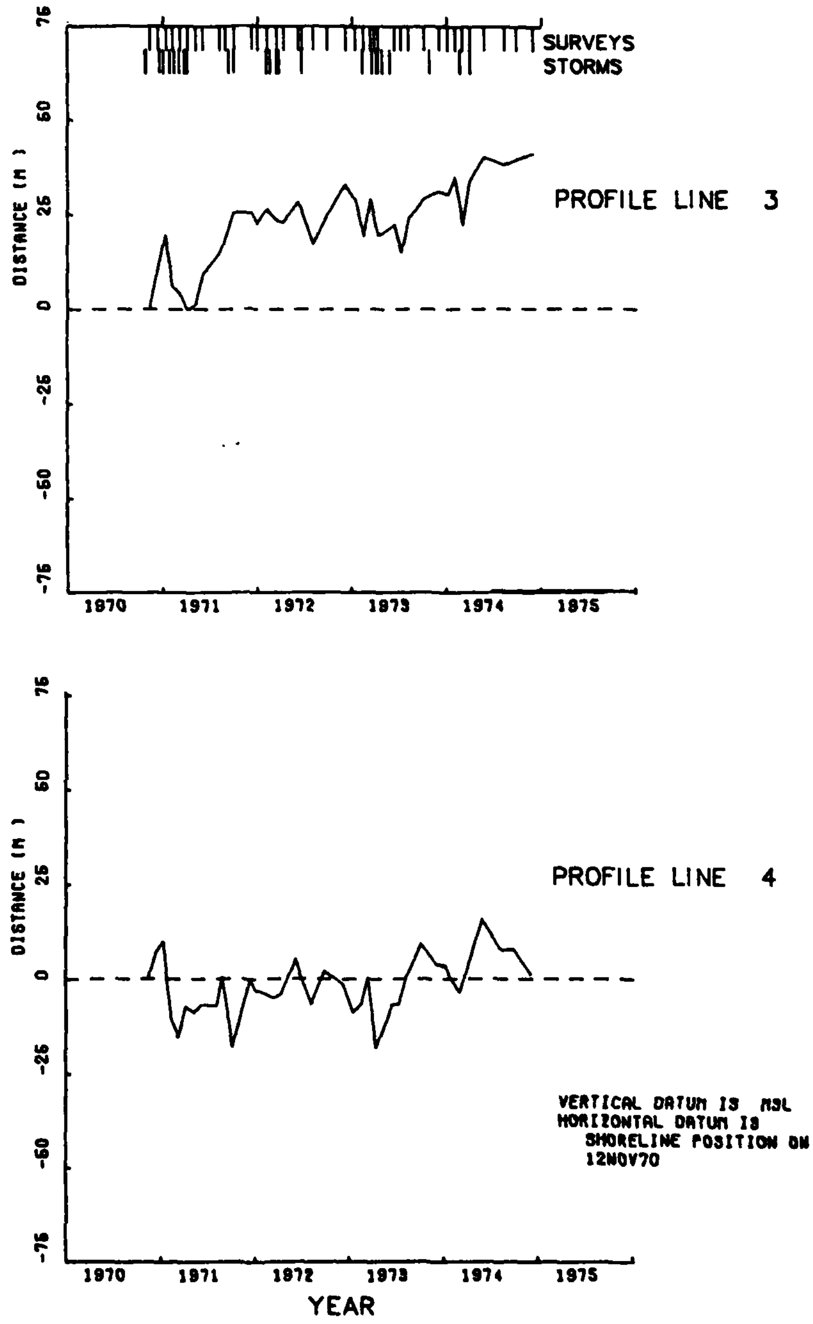
APPENDIX C

CHANGE IN MSL SHORELINE POSITION

This appendix shows the distance from the backbeach datum to the MSL shoreline intercept relative to its position on the date of the first beach profile survey (12-18 Nov. 1970). The occurrences of identified storms and times of beach profile surveys throughout the study period are also provided.



CHANGE IN DISTANCE TO SHORE LINE



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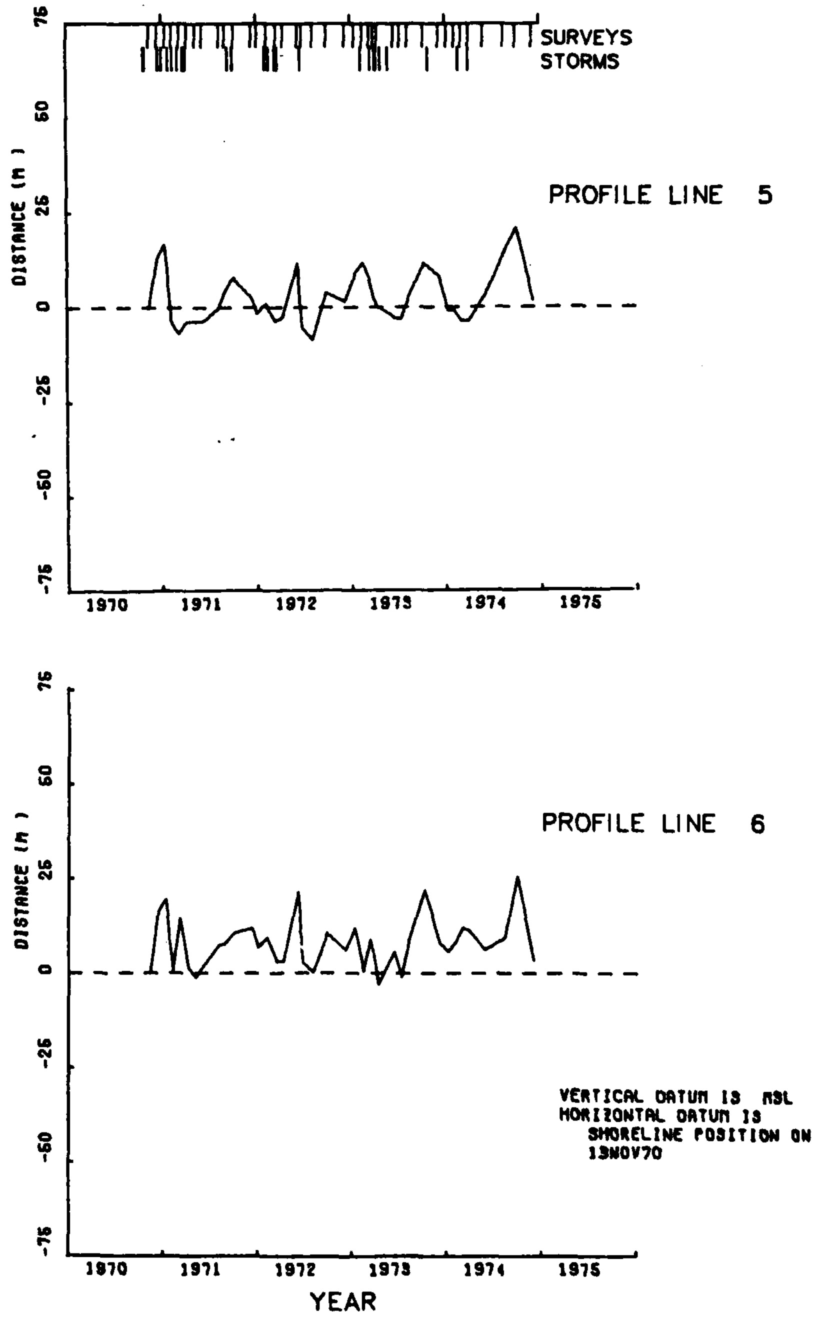

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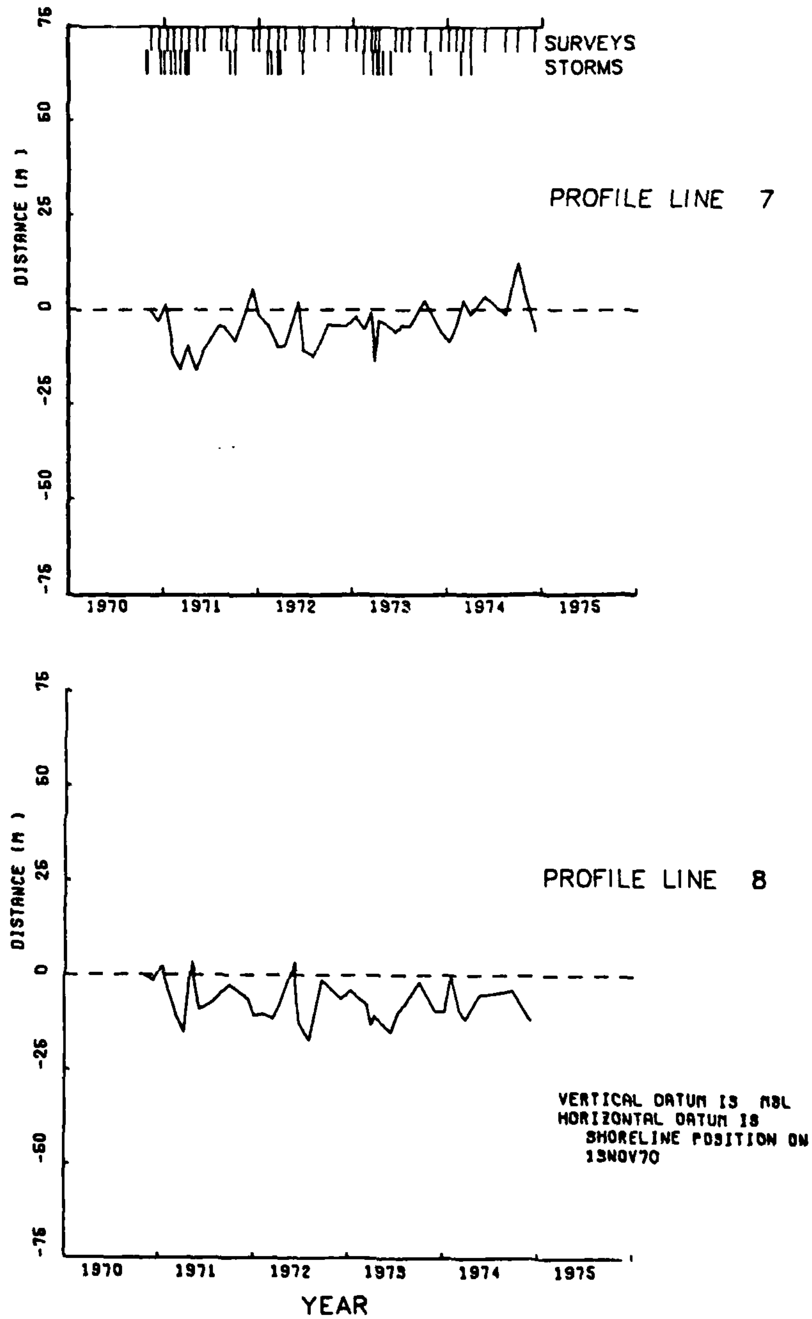

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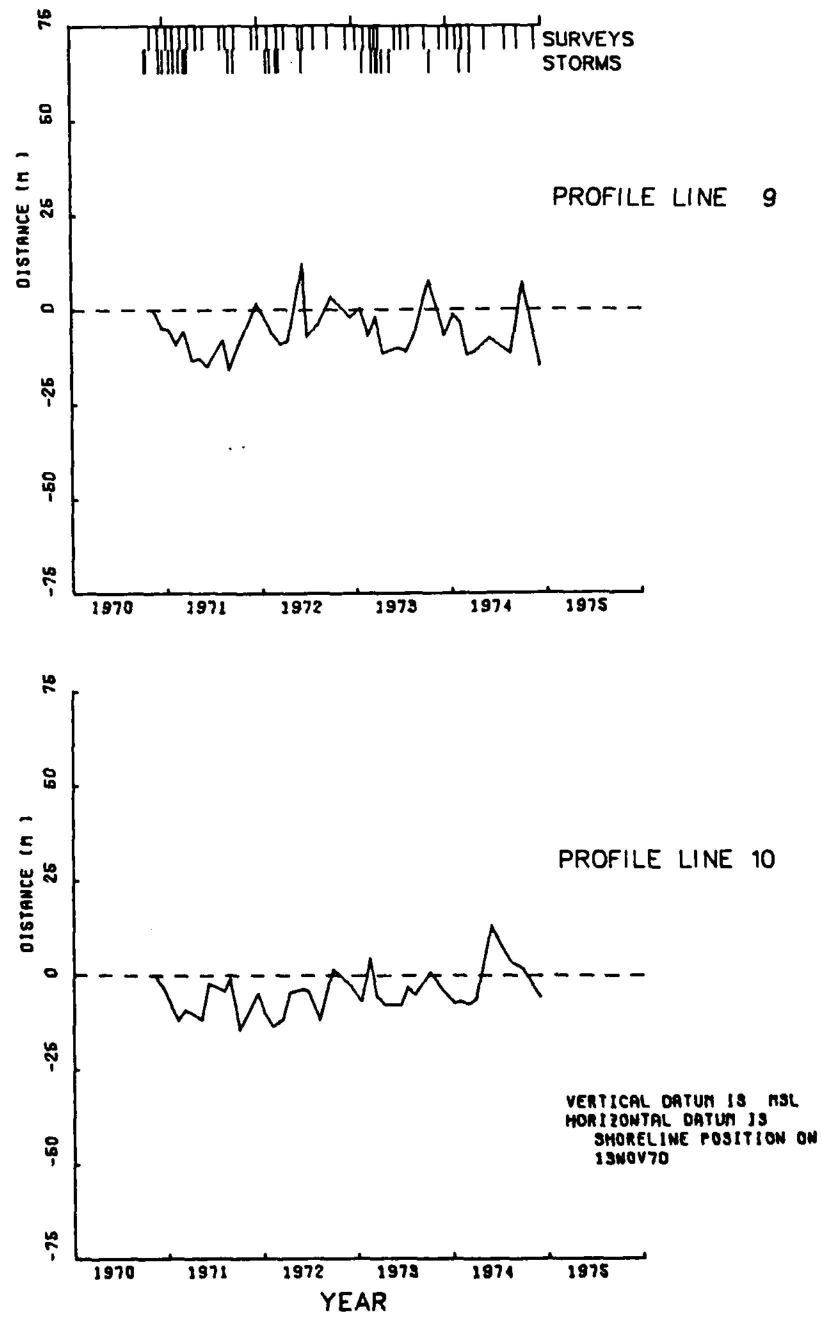
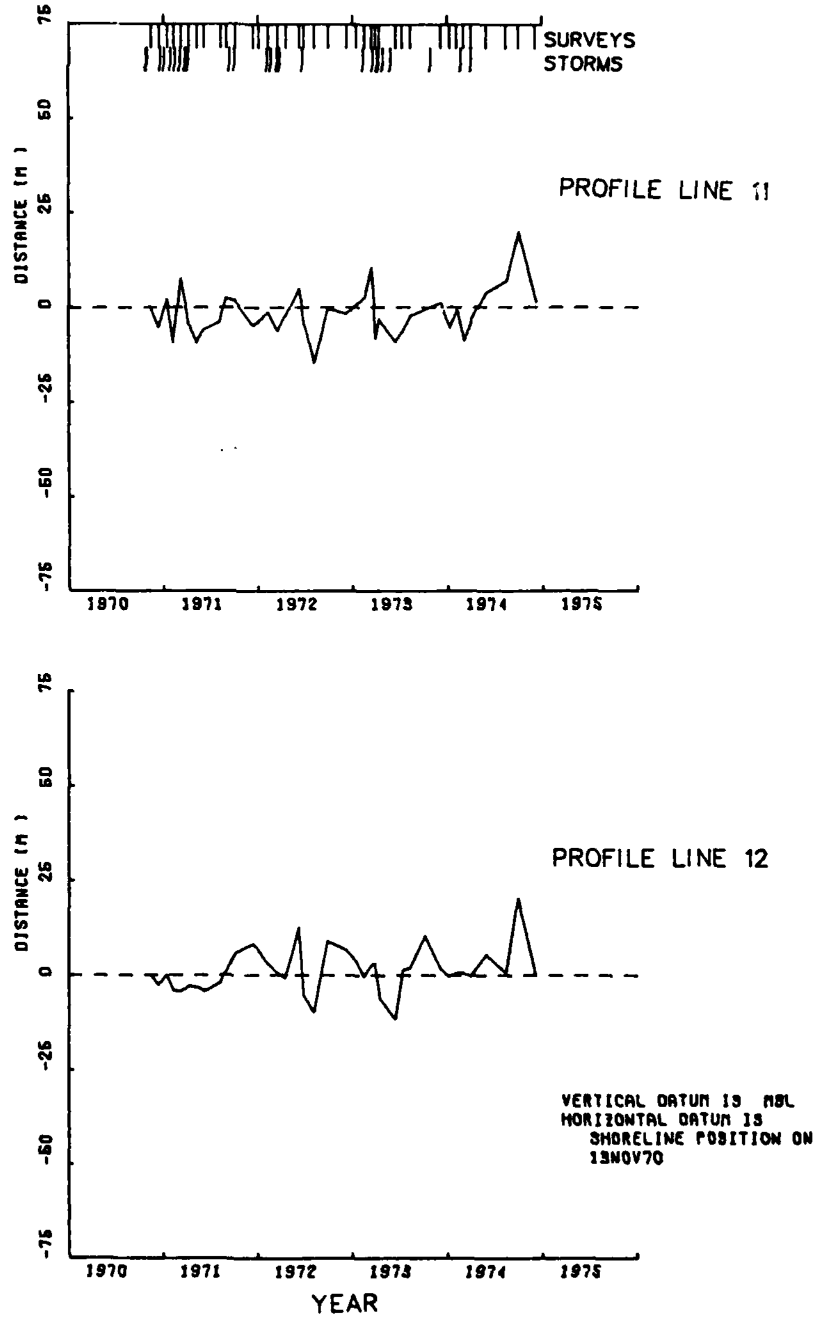
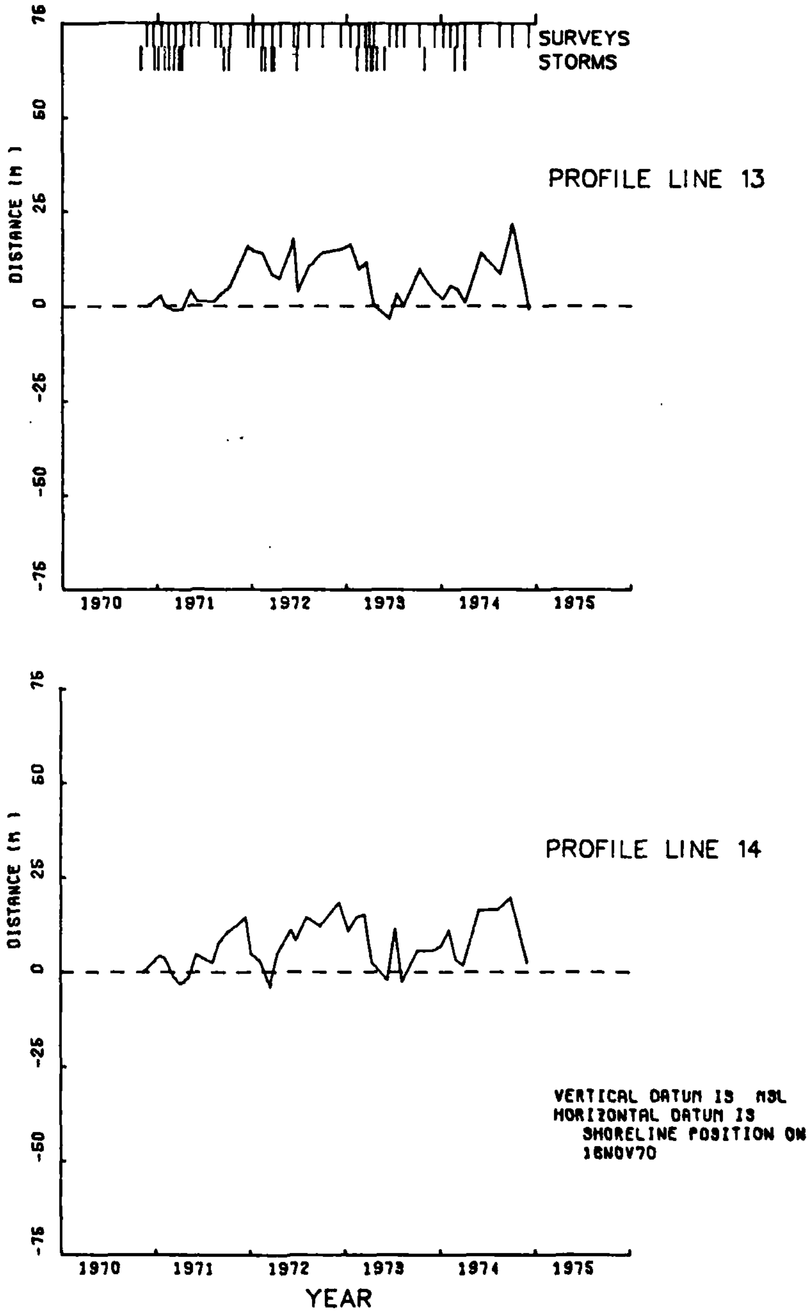


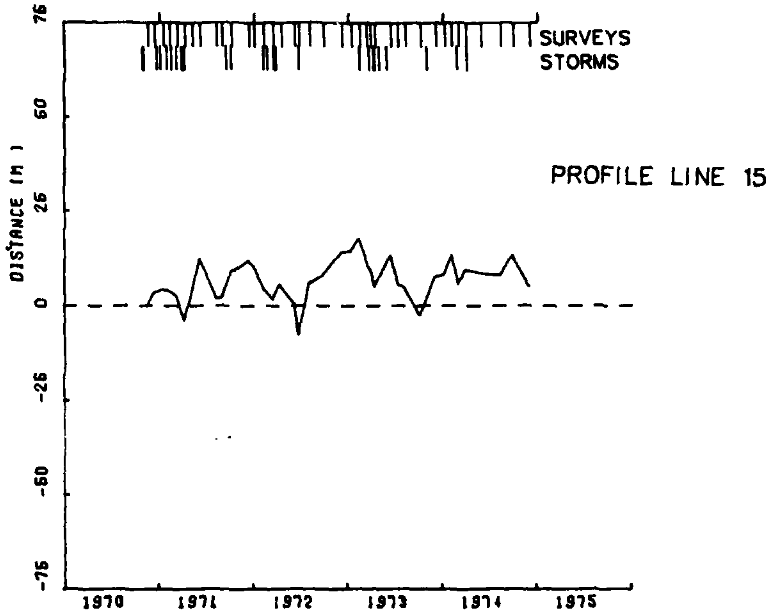
CHANGE IN DISTANCE TO SHORE LINE

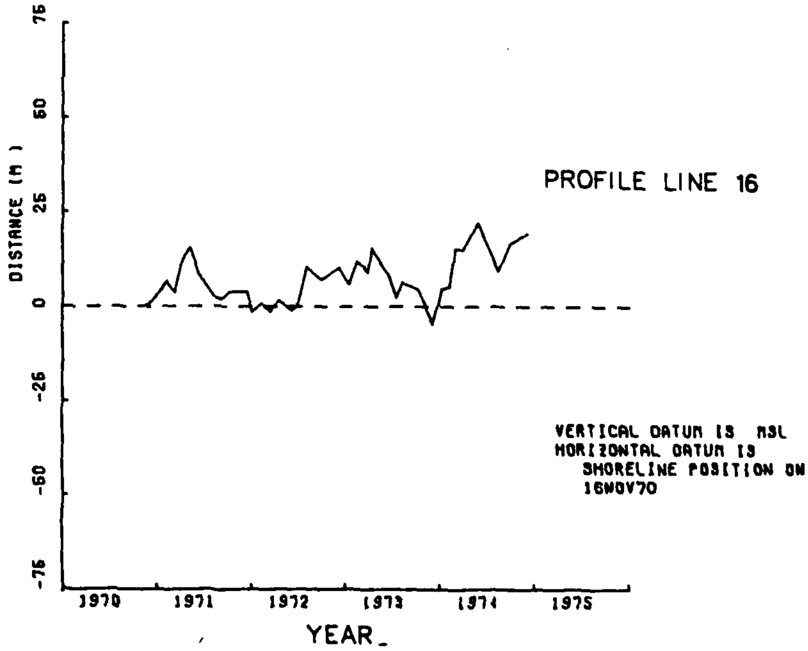


CHANGE IN DISTANCE TO SHORE LINE

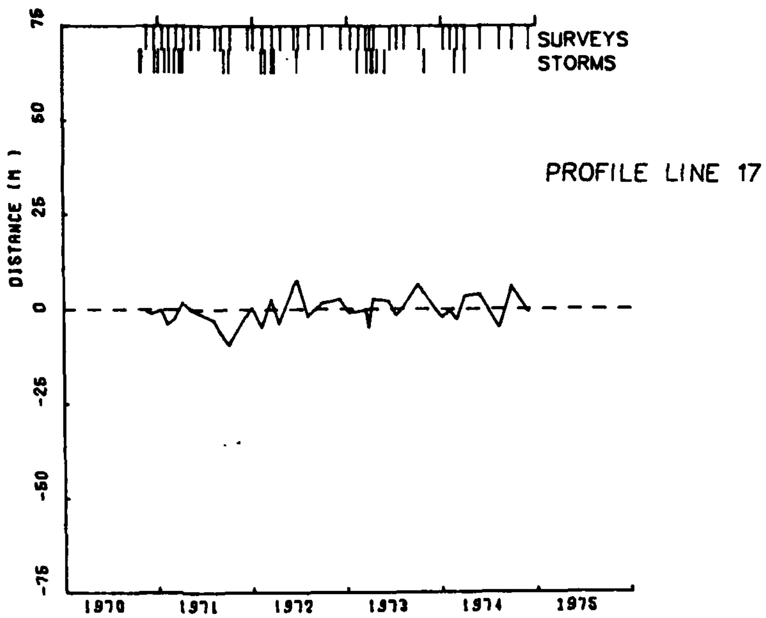


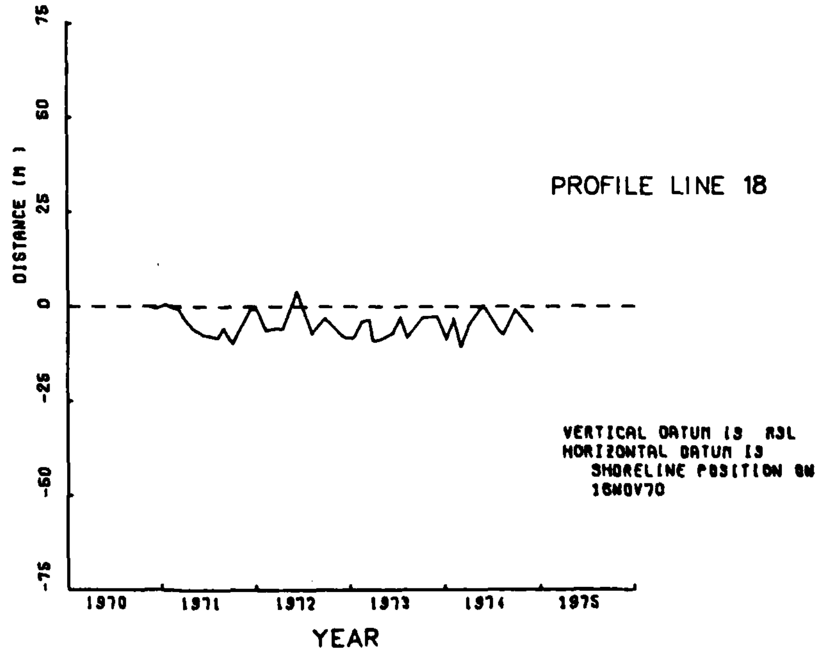
CHANGE IN DISTANCE TO SHORE LINE



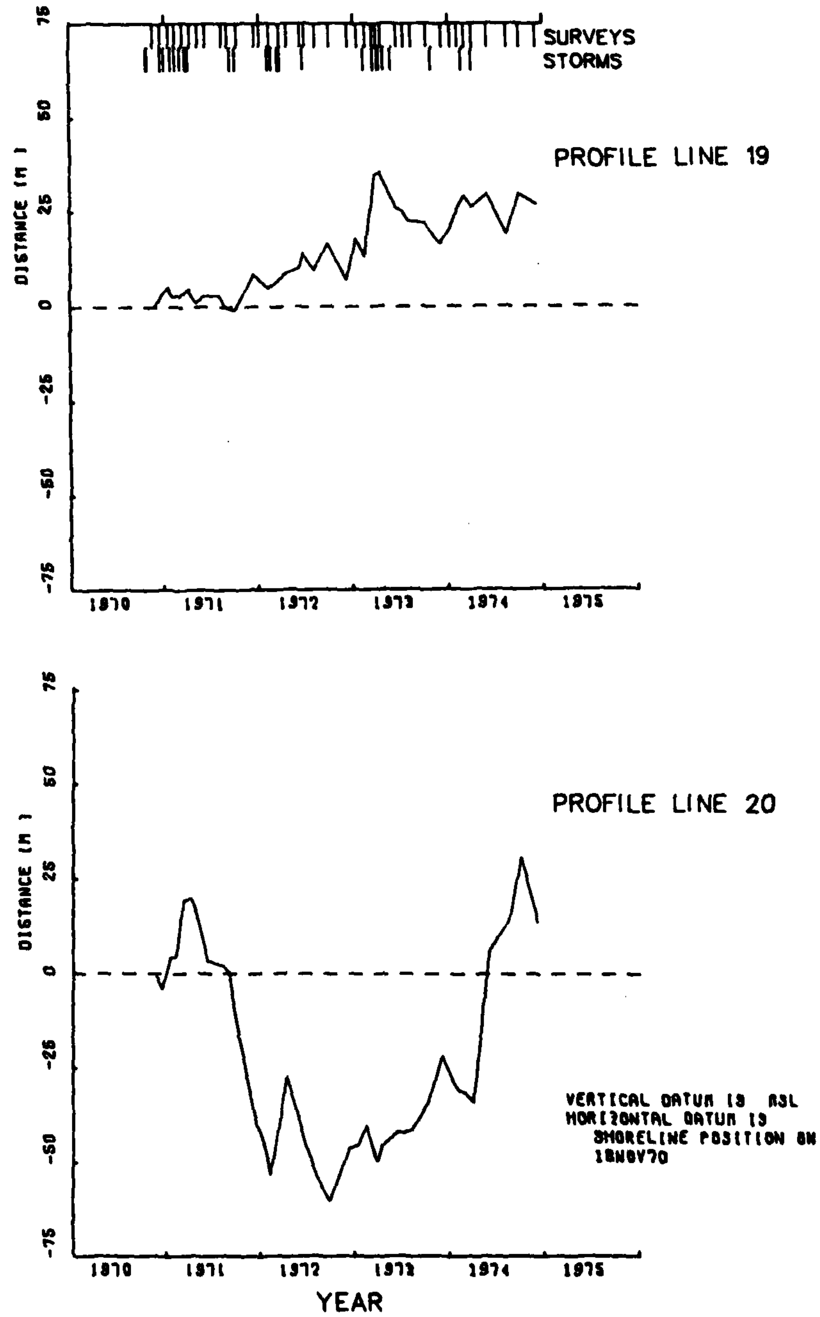


CHANGE IN DISTANCE TO SHORE LINE

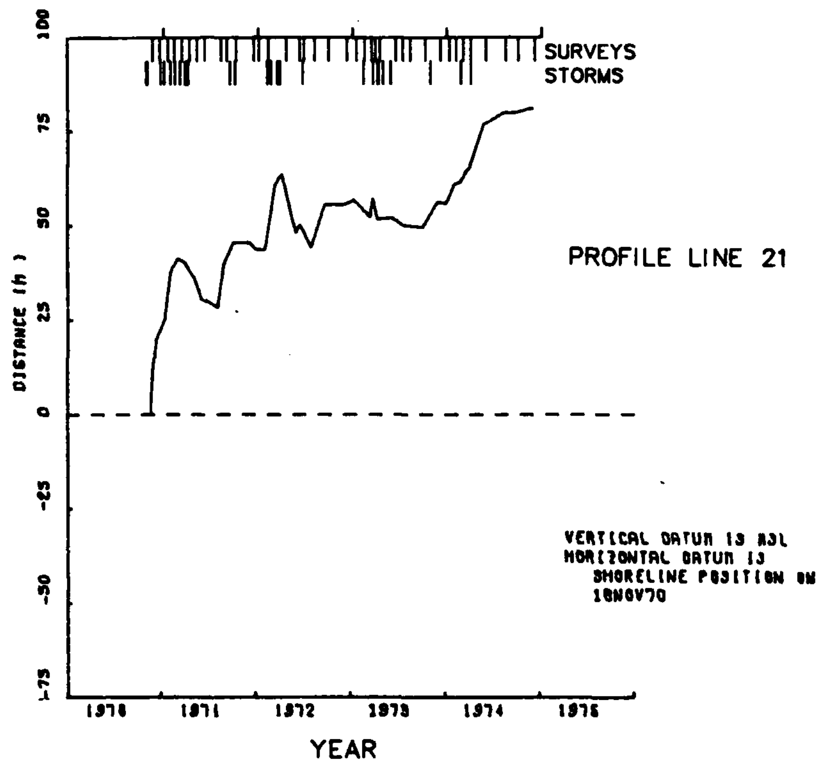




CHANGE IN DISTANCE TO SHORE LINE



CHANGE IN DISTANCE TO SHORE LINE

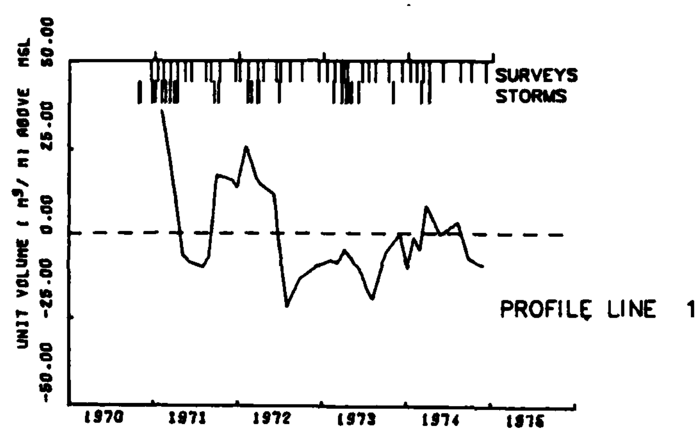


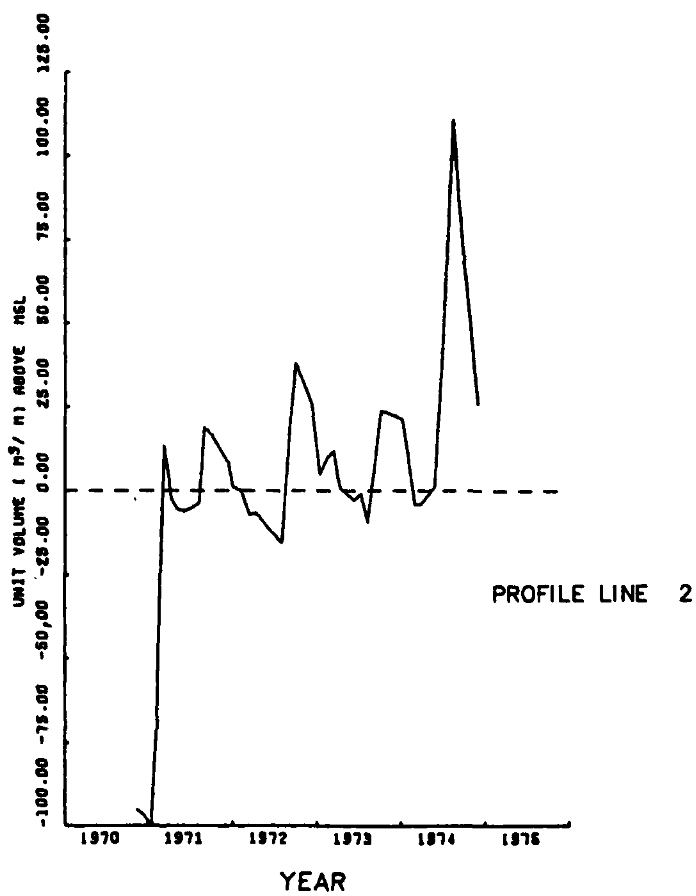
CHANGE IN DISTANCE TO SHORE LINE

APPENDIX D

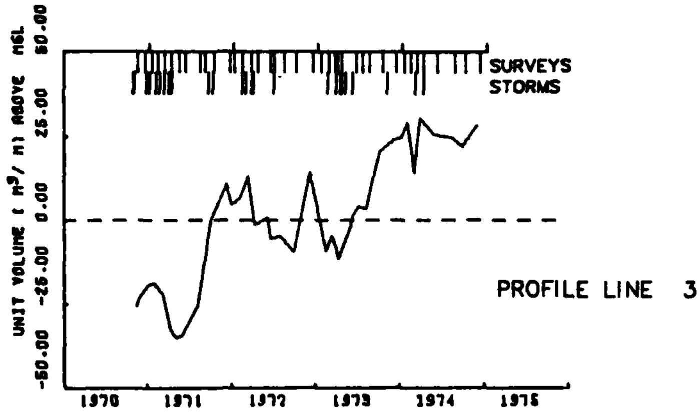
CHANGE IN ABOVE MSL UNIT VOLUME

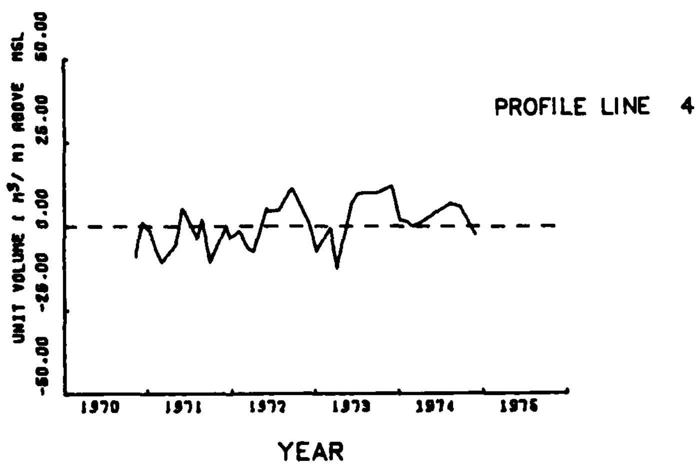
The unit volume is the volume per unit width (cubic meters per meter) bounded by a horizontal line passing through the MSL position, a vertical line at the backbeach datum and the measured beach profile. This appendix shows the above MSL volume at successive beach profile measurements relative to the long-term mean above MSL unit volume. The time of beach profile measurements and occurrences of identified storms is also provided.





UNIT VOLUME CHANGES





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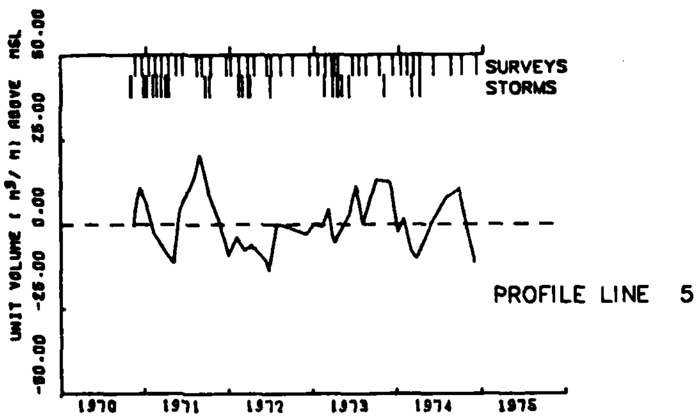
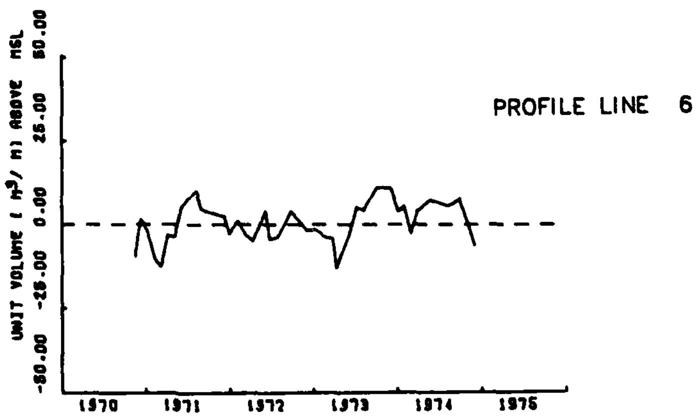
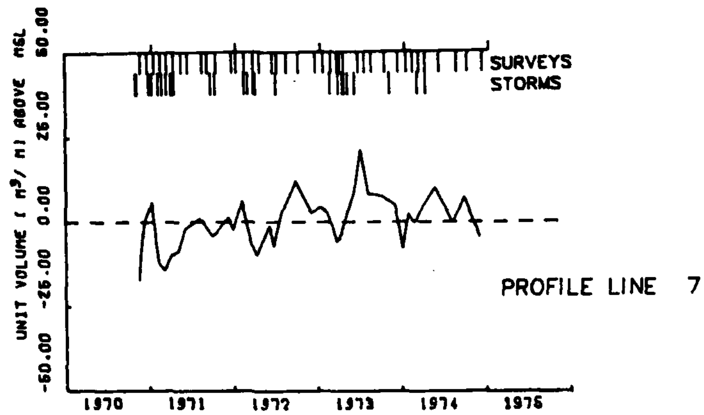
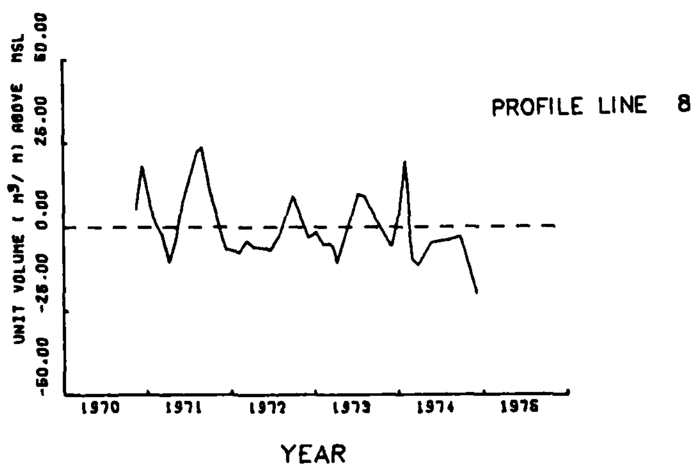




YEAR

UNIT VOLUME CHANGES





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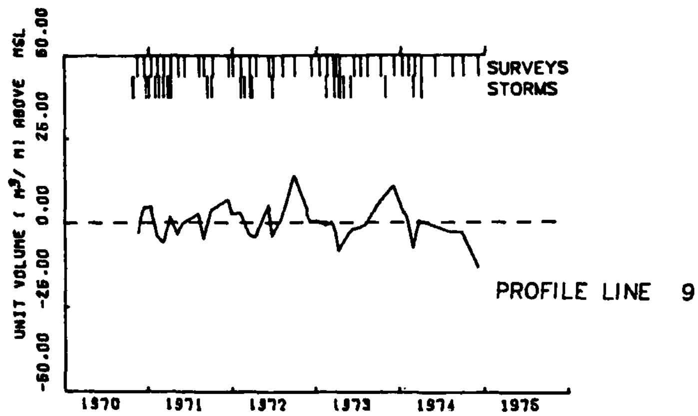

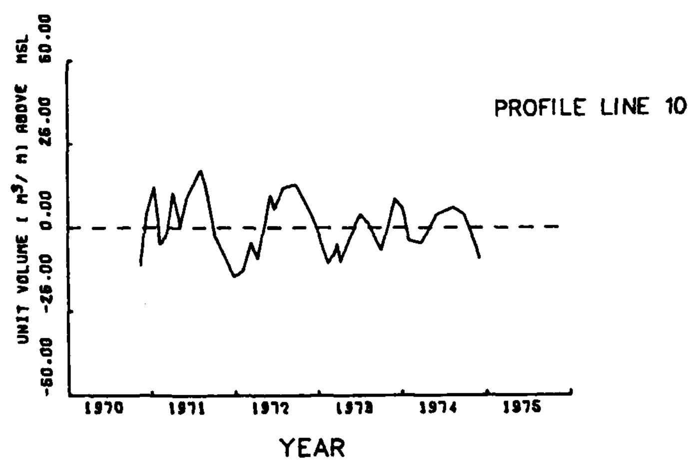

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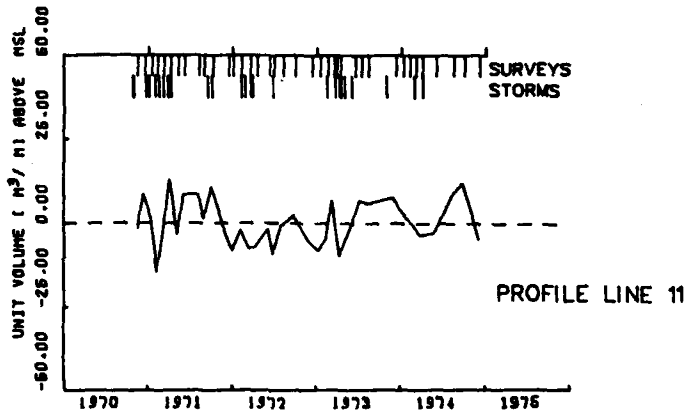
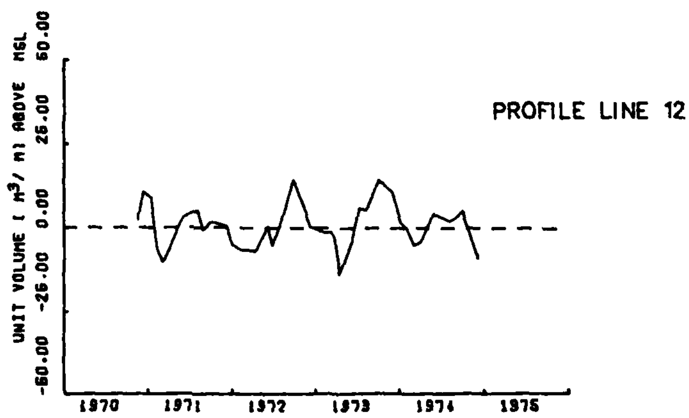
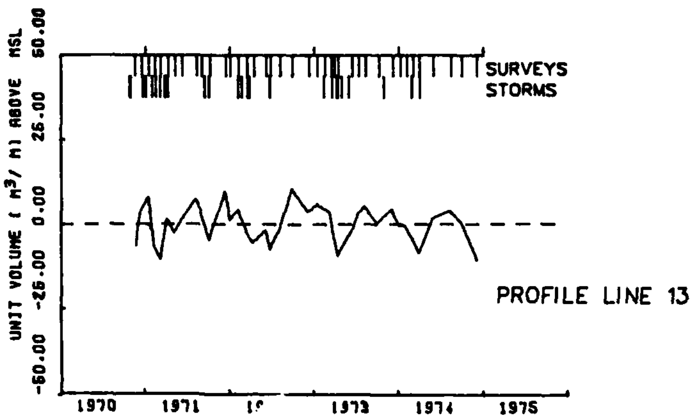
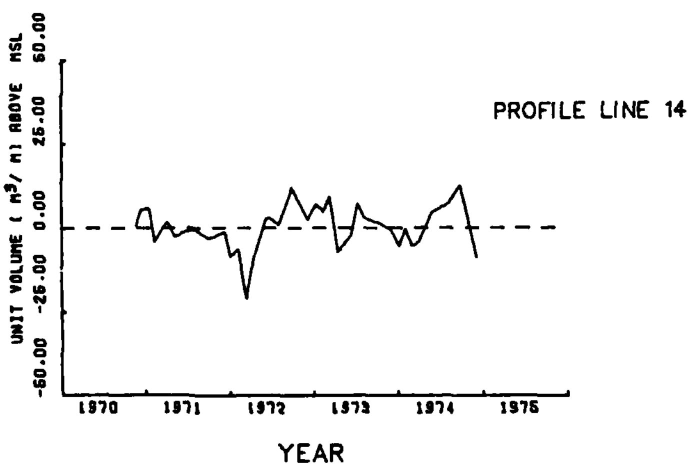




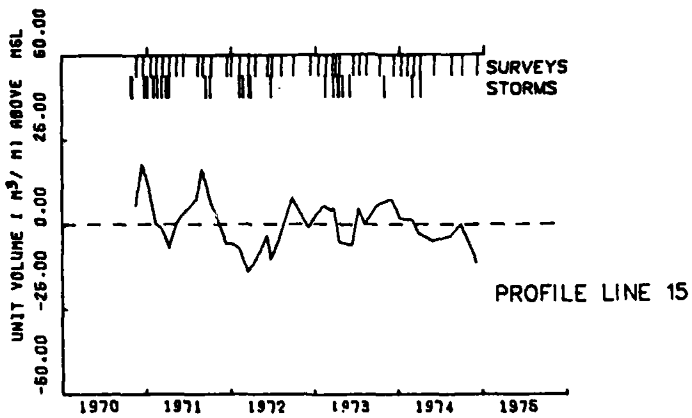
YEAR

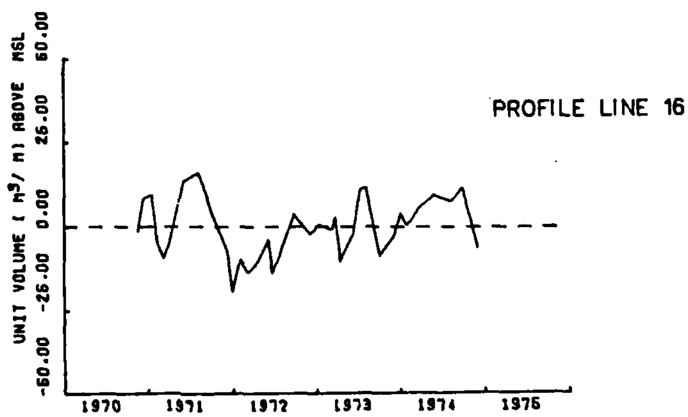
UNIT VOLUME CHANGES





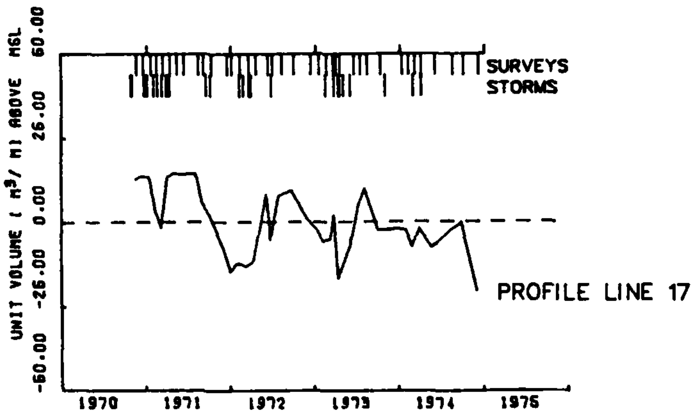
UNIT VOLUME CHANGES

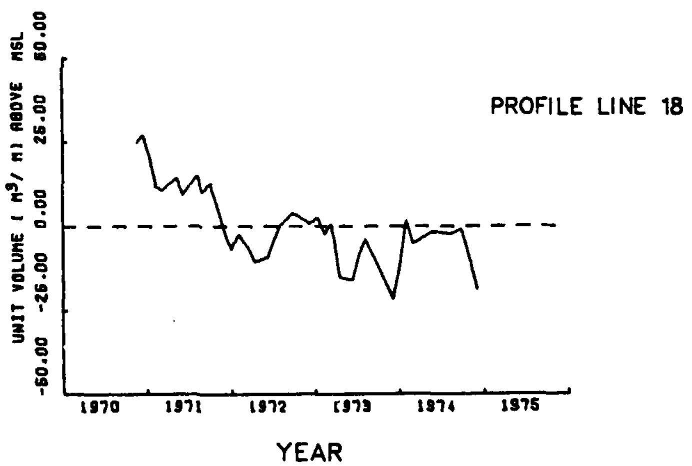




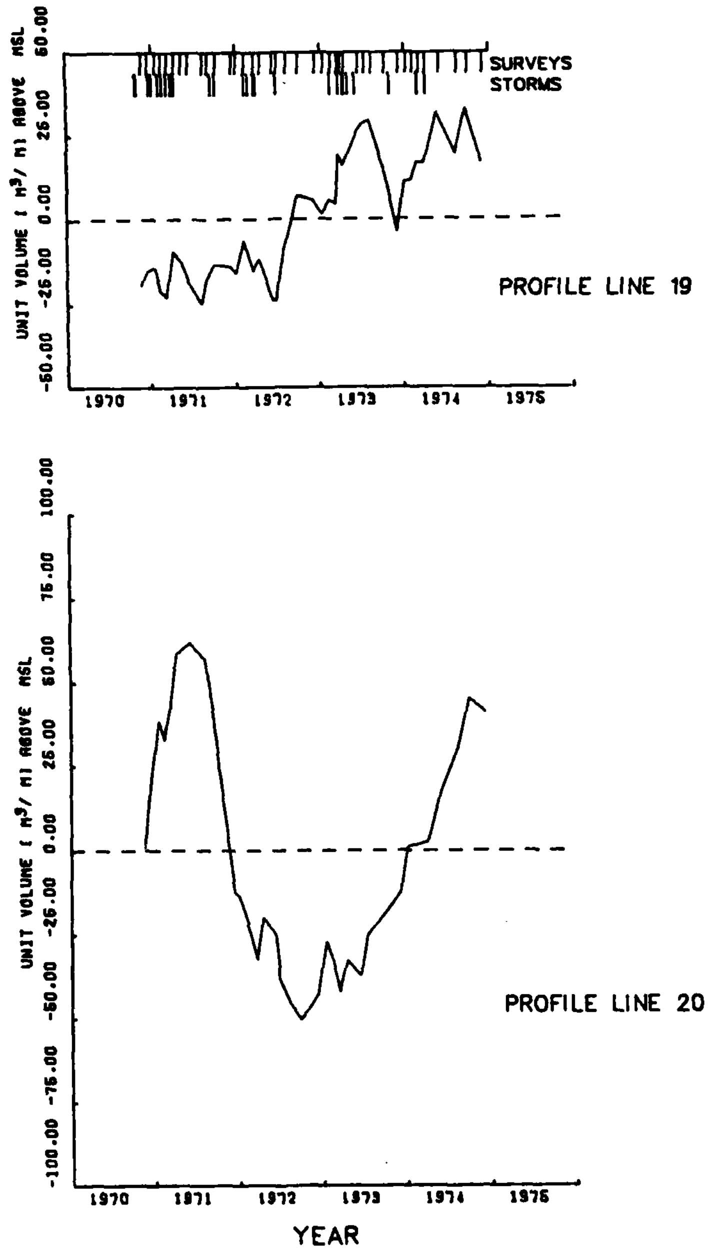
YEAR

UNIT VOLUME CHANGES





UNIT VOLUME CHANGES



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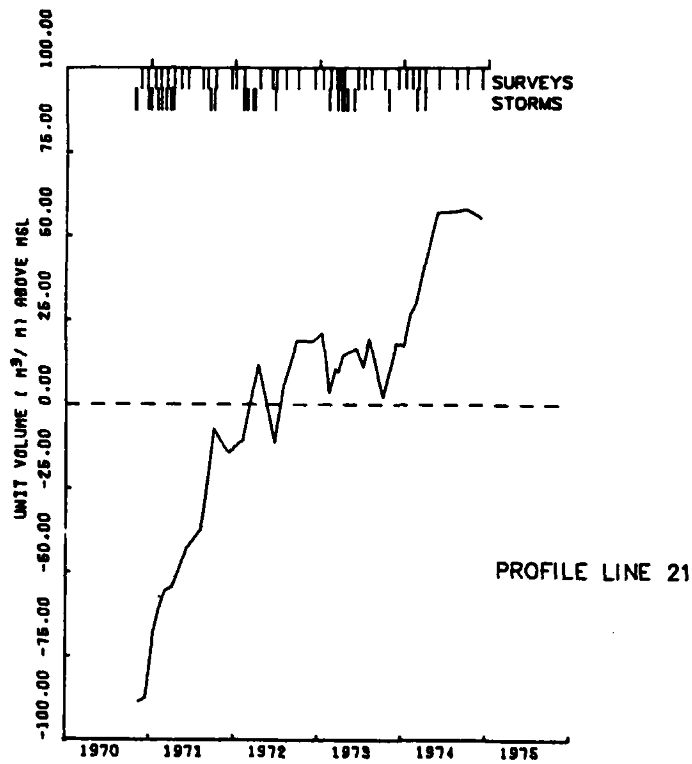


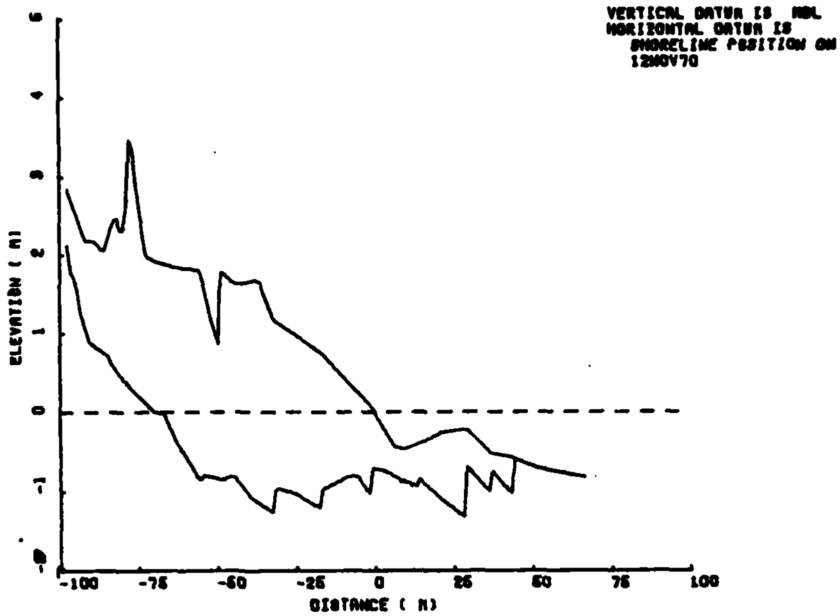
YEAR

UNIT VOLUME CHANGES

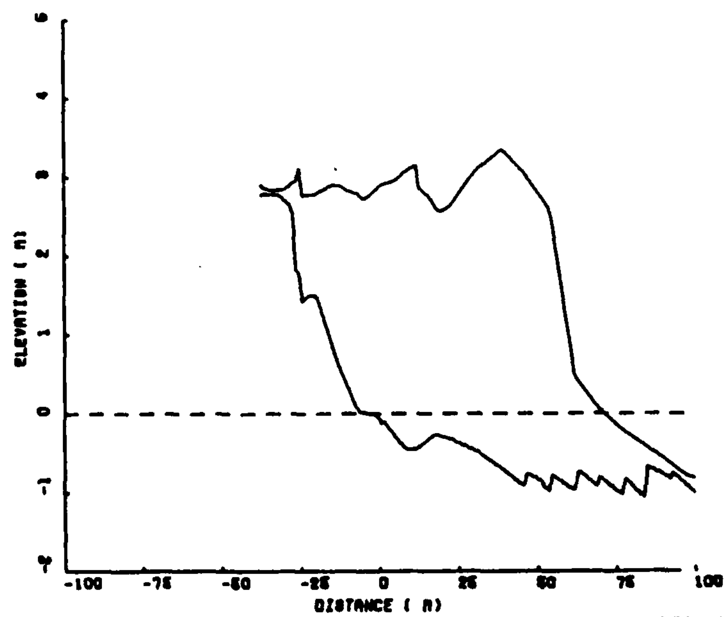
APPENDIX E

PROFILE ENVELOPES

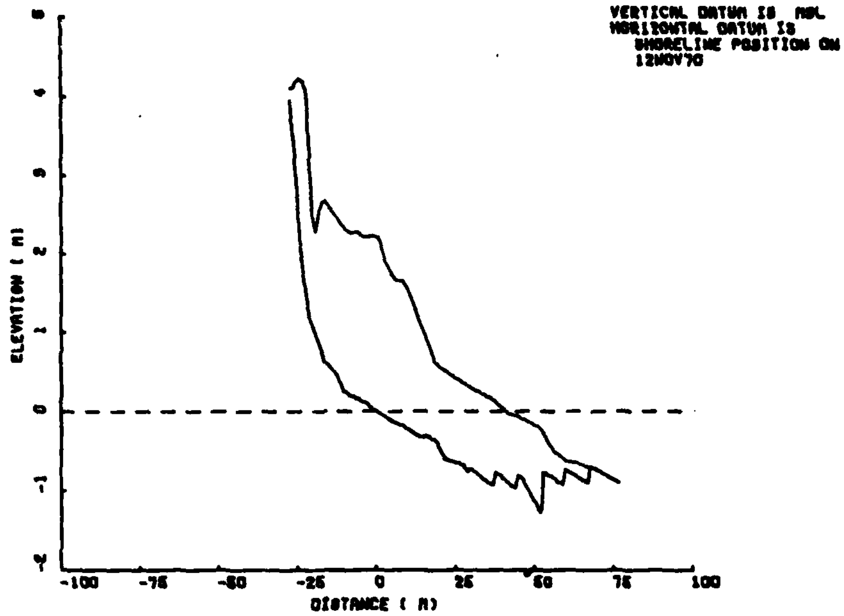
This appendix provides the position of the maximum and minimum sand elevations along the profile line during the study period relative to the National Geodetic Vertical Datum of 1929. Horizontal positions are measured from the MSL shoreline intercept on the first survey of the study (12-18 Nov. 1970).



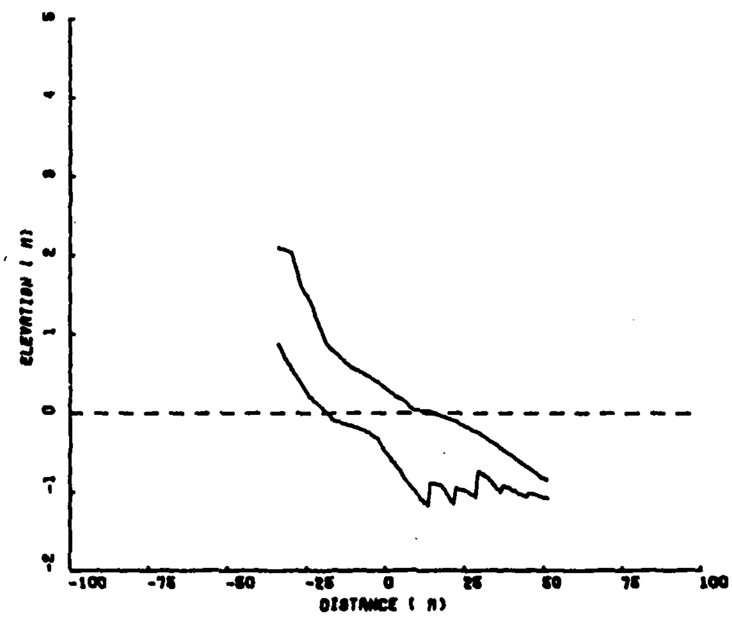
PROFILE ENVELOPE FOR PROFILE LINE 1 AT HOLDEN BEACH, NC
12NOV70 - 3DEC74



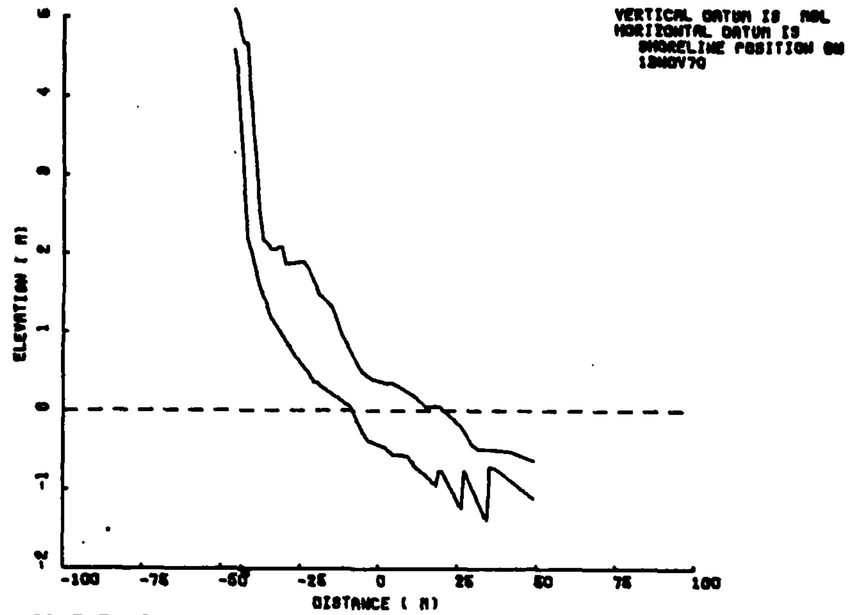
PROFILE ENVELOPE FOR PROFILE LINE 2 AT HOLDEN BEACH, NC
12NOV70 - 3DEC74



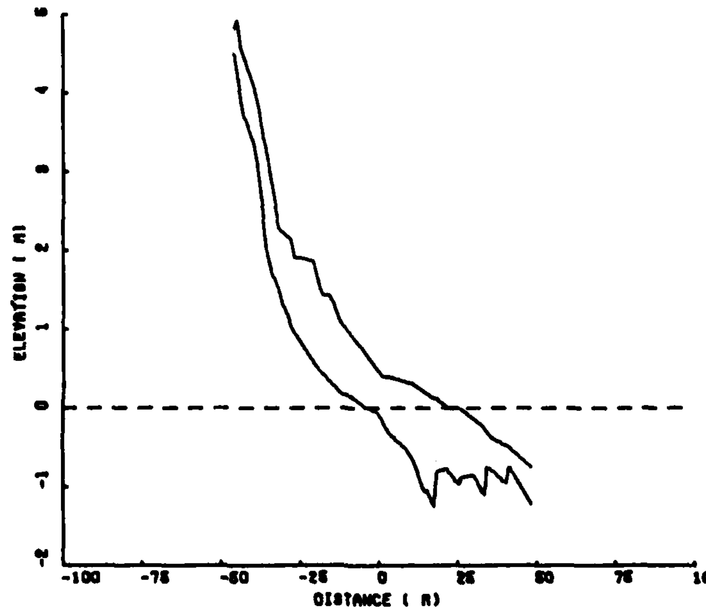
PROFILE ENVELOPE FOR PROFILE LINE 3 AT HOLDEN BEACH, NC
12NOV70 - 3DEC74



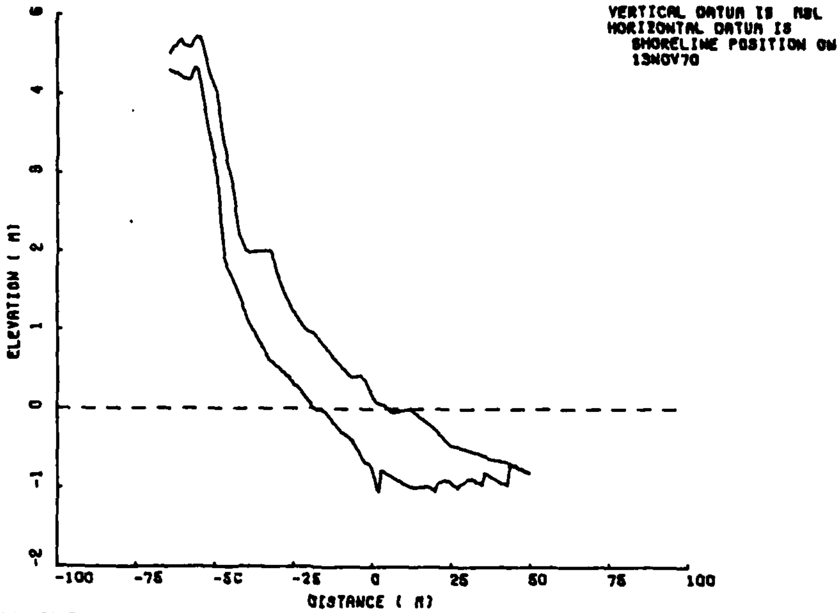
PROFILE ENVELOPE FOR PROFILE LINE 4 AT HOLDEN BEACH, NC
13NOV70 - 3DEC74



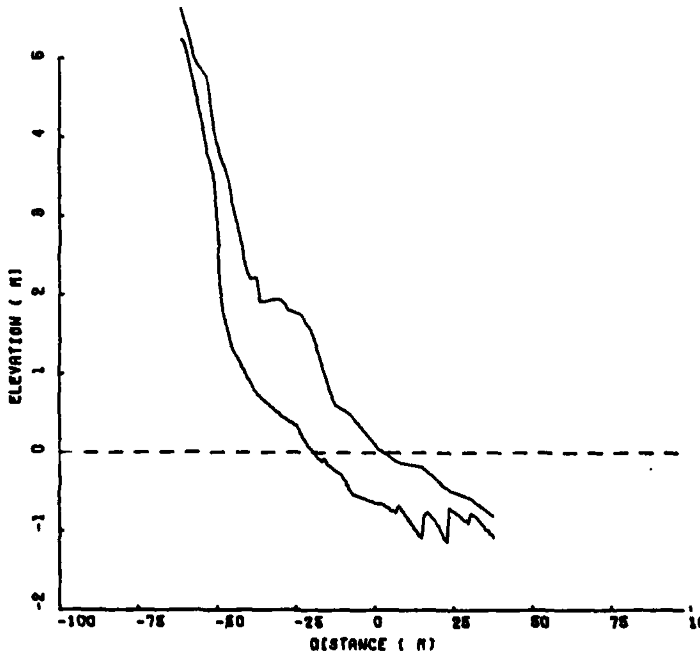
PROFILE ENVELOPE FOR PROFILE LINE 5 AT HOLDEN BEACH, NC
13NOV70 - 3DEC74



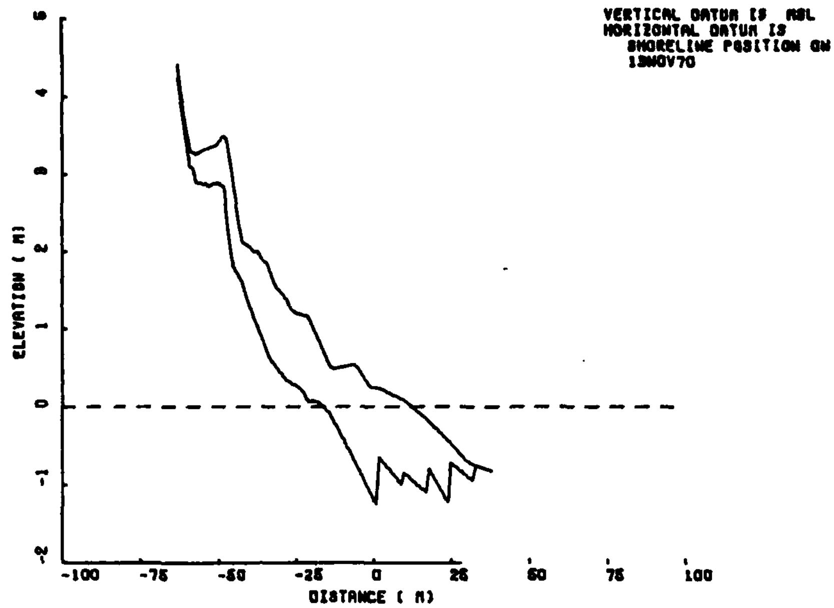
PROFILE ENVELOPE FOR PROFILE LINE 6 AT HOLDEN BEACH, NC
13NOV70 - 3DEC74



PROFILE ENVELOPE FOR PROFILE LINE 7 AT HOLDEN BEACH, NC
13NOV70 - 4DEC74



PROFILE ENVFLOPE FOR PROFILE LINE 8 AT HOLDEN BEACH, NC
13NOV70 - 4DEC74



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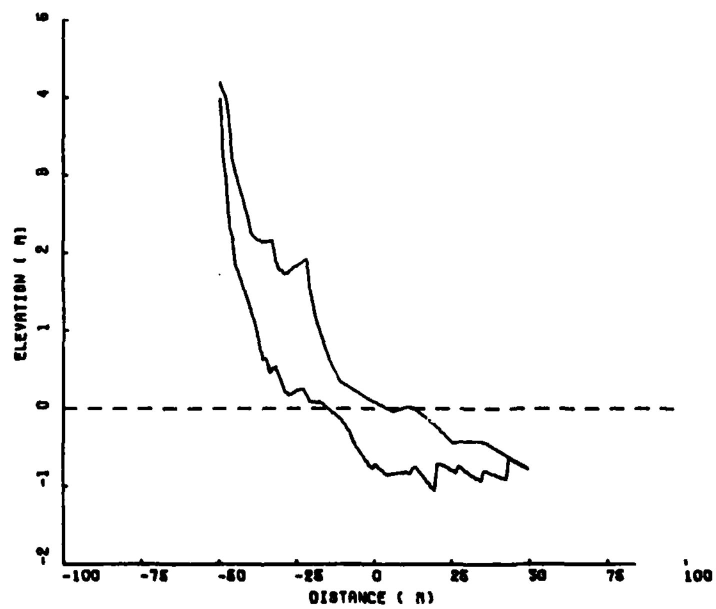
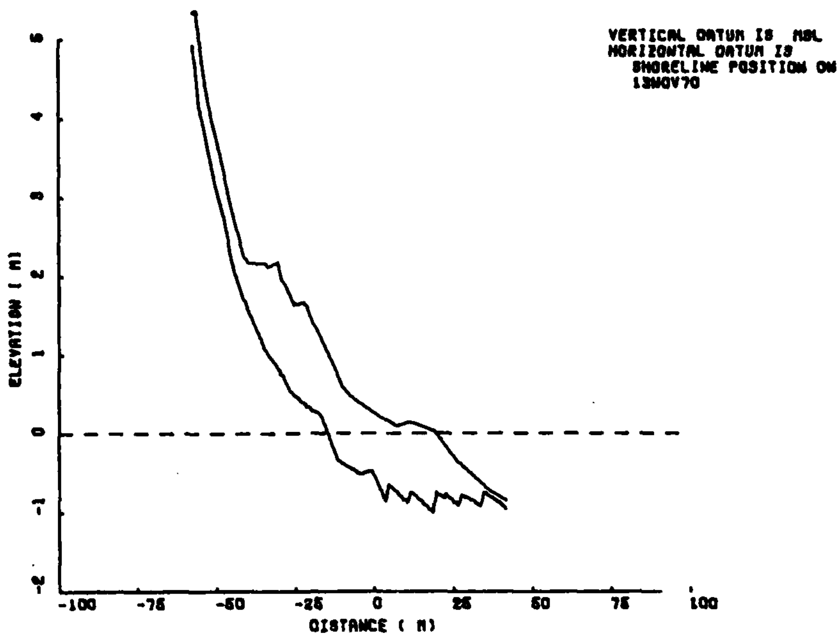


PROFILE ENVELOPE FOR PROFILE LINE 10 AT HOLDEN BEACH, NC
13NOV70 - 4DEC74



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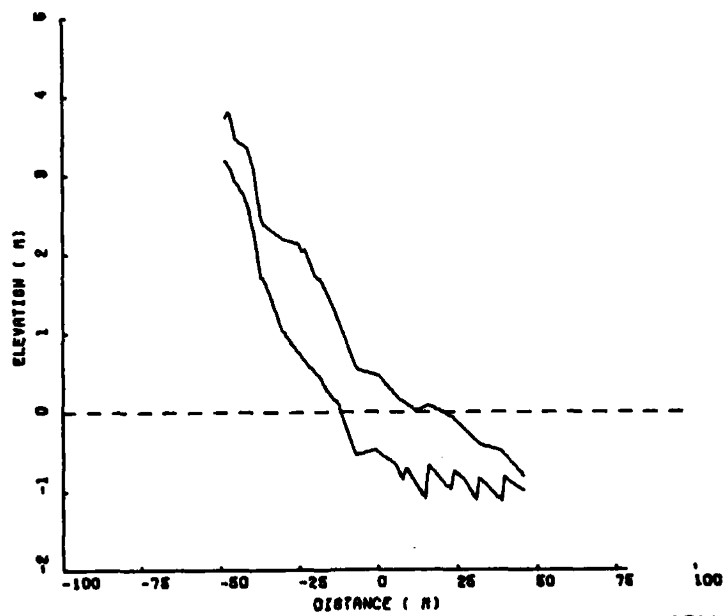
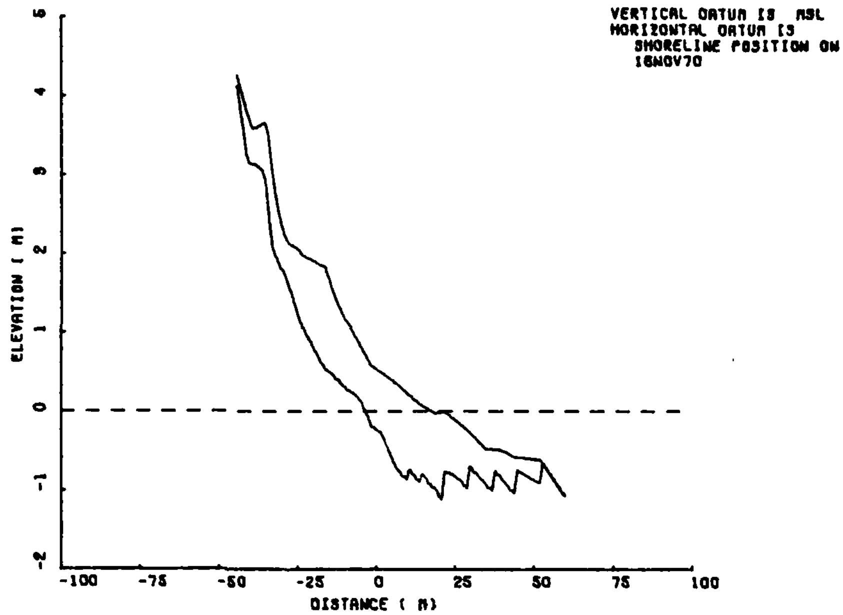
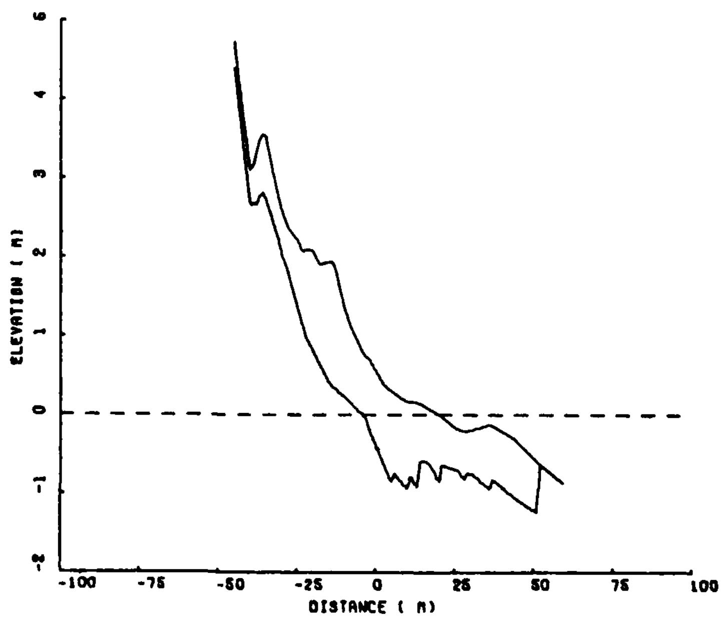
13NOV70 - 4DEC74



PROFILE ENVELOPE FOR PROFILE LINE 12 AT HOLDEN BEACH, NC
16NOV70 - 4DEC74



PROFILE ENVELOPE FOR PROFILE LINE 13 AT HOLDEN BEACH, NC
16NOV70 - 4DEC74



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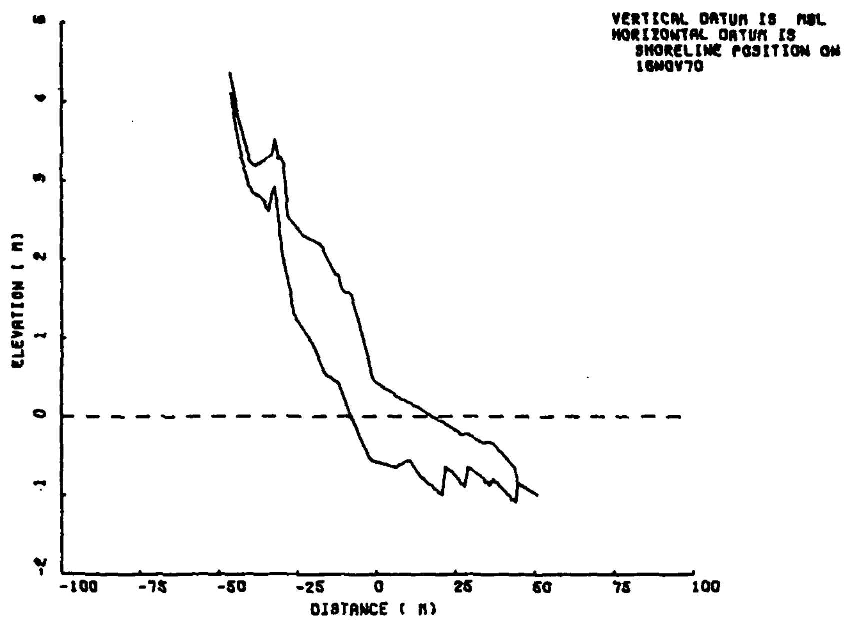

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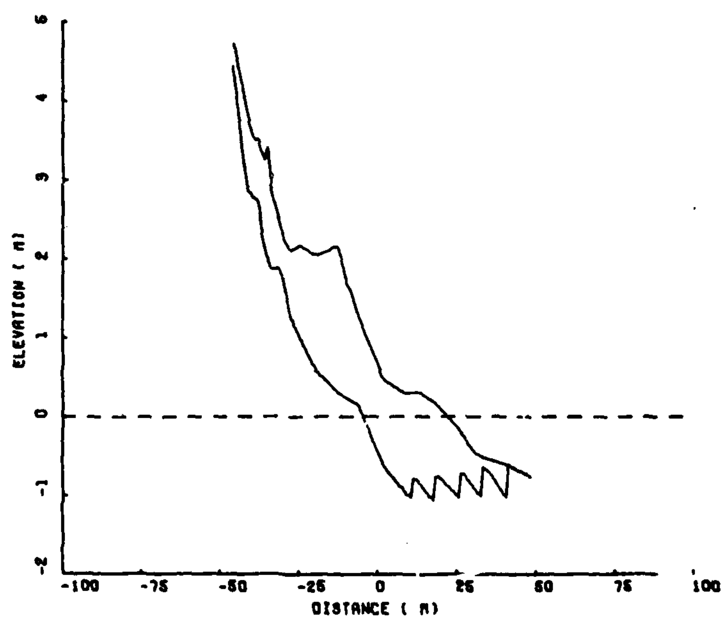
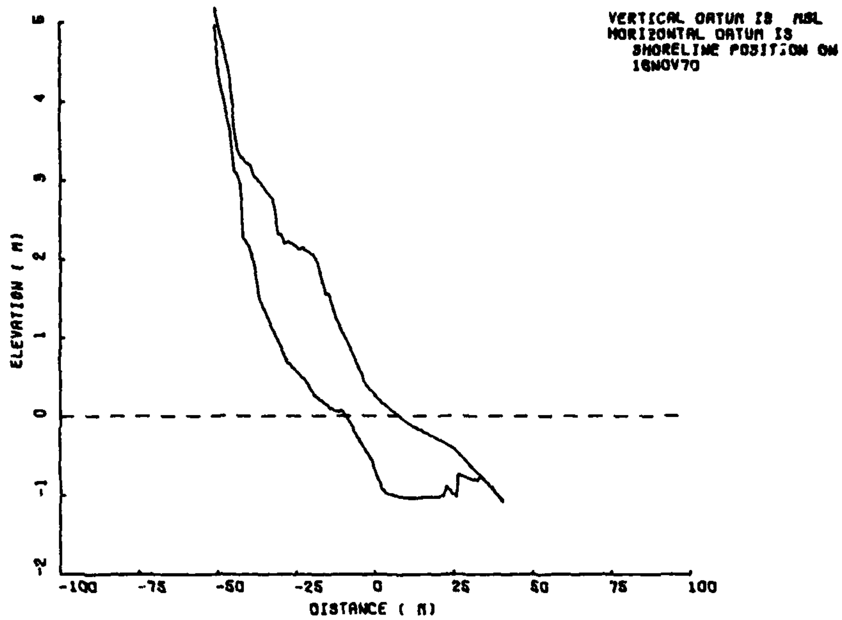
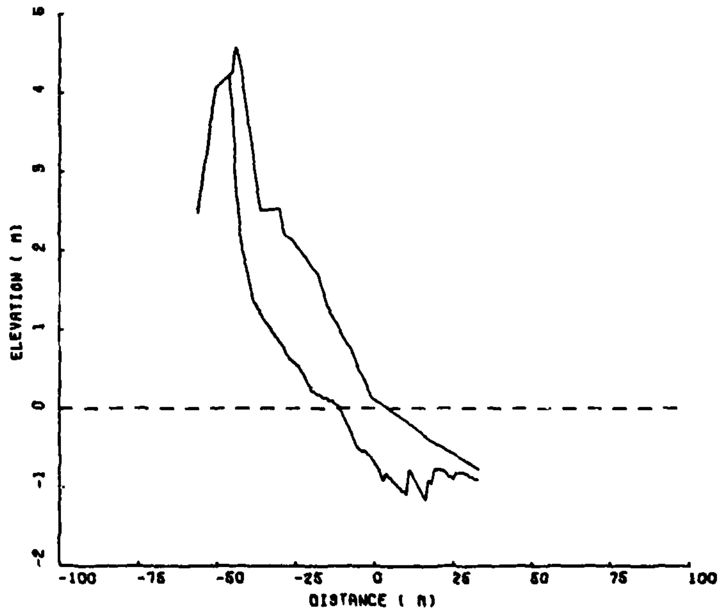
16NOV70 - 4DEC74



PROFILE ENVELOPE FOR PROFILE LINE 16 AT HOLDEN BEACH, NC
16NOV70 - 5DEC74



PROFILE ENVELOPE FOR PROFILE LINE 17 AT HOLDEN BEACH, NC
16NOV70 - 5DEC74



PROFILE ENVELOPE FOR PROFILE LINE 18 AT HOLDEN BEACH, NC
16NOV70 - 5DEC74

AD-A127 986 BEACH CHANGES AT HOLDEN BEACH NORTH CAROLINA 1970-74 (U) SCIENCE APPLICATIONS INC RALEIGH NC M C MILLER MAR 83 CERC-MR-83-5 DACW72-79-C-0020

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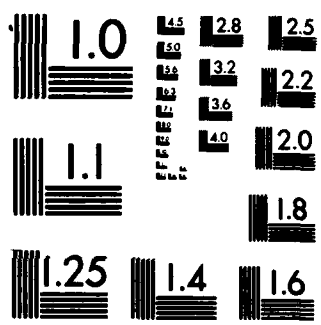
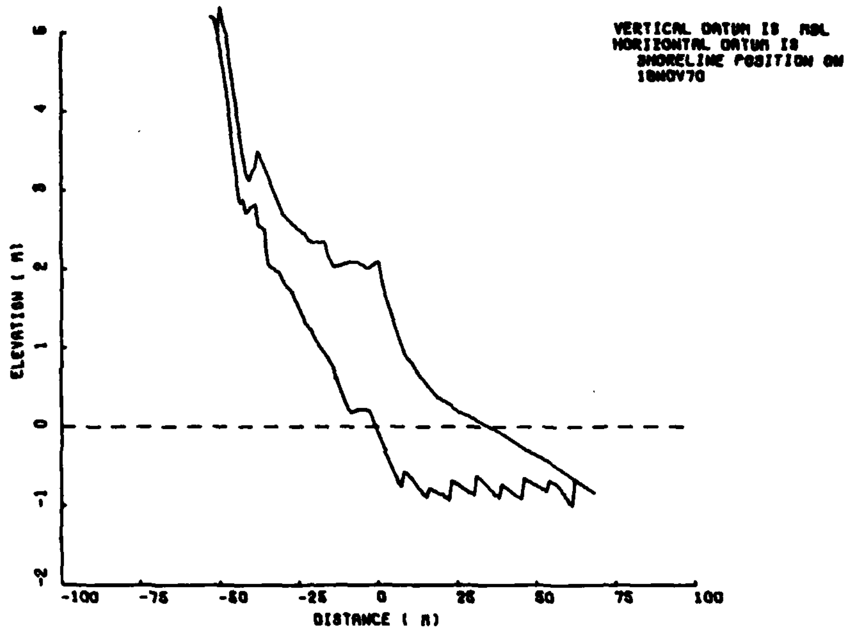
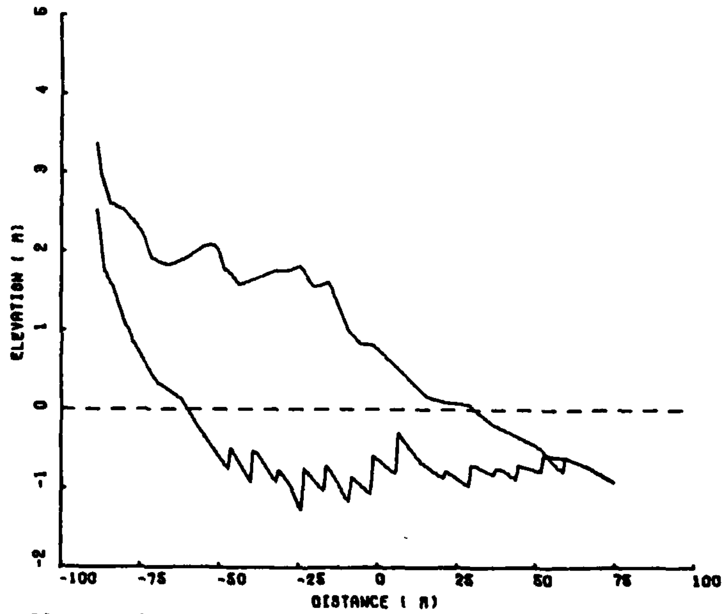


MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A



PROFILE ENVELOPE FOR PROFILE LINE 19 AT HOLDEN BEACH, NC
18NOV70 - 5DEC74



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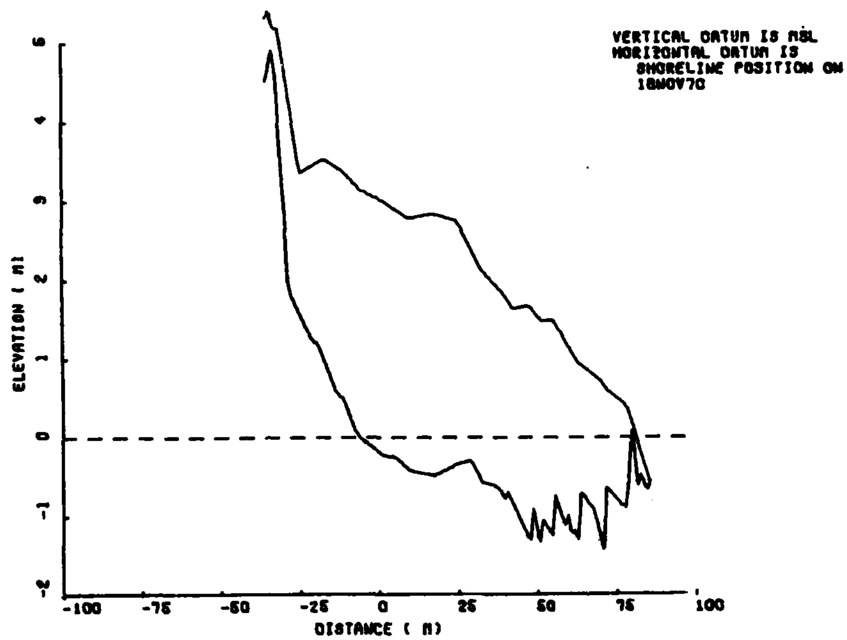

PROFILE ENVELOPE FOR PROFILE LINE 21 AT HOLDEN BEACH, NC
18NOV70 - 5DEC74

Miller, Martin C.

Beach changes at Holden Beach, North Carolina, 1970-74 / by Martin C. Miller.--Fort Belvoir, Va. : U.S. Army, Corps of Engineers, Coastal Engineering Research Center ; Springfield, Va. : available from NTIS, 1983.

[94] p. : ill. ; 29 cm.--(Miscellaneous report / Coastal Engineering Research Center ; no. 83-5)

Cover title.

"March 1983."

Report provides basic engineering information on changes in the volume of sand on beaches above mean sea level, and on changes in shoreline position, as obtained from long-term beach survey projects.

1. Beach changes. 2. Beach erosion control. 3. Beach profile surveys. 4. Holden Beach, North Carolina. 5. Storm erosion. I. Title. II. Coastal Engineering Research Center (U.S.). III. Series: Miscellaneous report (Coastal Engineering Research Center (U.S.)); no. 83-5.

TC203 .U581mr no. 83-5 627

Miller, Martin C.

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